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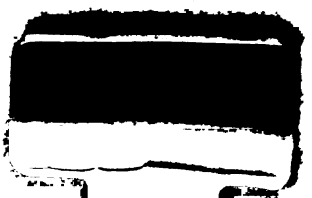

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Medical and Surgical

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ADVANCES IN BACTERIOLOGY.

AN ADDRESS

DELIVERED BEFORE THE TENTH INTERNATIONAL MEDICAL CONGRESS, AUGUST 4, 1890.

BY

R. KOCH, M.D.

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ADVANCES IN BACTERIOLOGY.

WHEN I accepted the honorable task of delivering one of the addresses to the International Congress, the choice was given to me of a subject connected with hygiene, in which science I am at present most occupied, or of one drawn from bacteriology, to which my time for years was formerly wholly dedicated.

I have decided for the latter because it seems to me that bacteriology has excited the greatest interest on every side, and therefore I propose to describe the present state of the science, at least in some of its important parts. To those already familiar with the subject I may have nothing new to offer; but that I may not appear quite empty-handed to them, I purpose to add certain facts from my own continued investigations which have not yet been made public.

Bacteriology, as far as it concerns physicians, is a very young science. Even up to fifteen years ago we knew little more than that in anthrax and in recurrent fever certain peculiar bodies appear in the blood, and that in wound-infection the so-called vibrio appears at times. No proof that these organisms were the cause of disease had then been furnished, and, excepting a few visionaries, most people considered them mere curiosities. At that time one could hardly think otherwise, for it had not been shown that these bodies were independent and specific for each disease. In decomposing fluids, as in the blood of suffocated animals, bacteria were found which closely resembled anthrax, and certain observers declared that they all were nothing but crystals. Bacteria like those of recurrent fever were found in marshes and in sordes, and micrococci like those of septic disease were said to be found in normal blood and tissue. Possessing only the optical and chemical methods of those days, no further progress could be made, but just at that time new methods were employed which at one stroke

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opened a way into the dark territory. With the aid of improved lenses and apparatus, seconded by the use of anilin stains, even the smallest bacteria could be seen and rendered separable from other micro-organisms morphologically. At the same time culture material was employed, either fluid or fixed as required, and thus the different germs could be isolated, pure cultures obtained, and the peculiar characters of each kind determined with certainty. What these new aids to investigation could do was very soon shown. A whole new series of distinct pathogenic organisms was discovered, and, even more important, their causal relation to disease proved. Since these new-found causes of disease all belonged to the bacteria, appearances seemed to show that all infectious diseases were due to particular bacteria in each case, different from all similar organisms, and we hoped that before long we should find for each disease a proper germ.

This hope has not been fulfilled, and the farther developments of bacteriology have been in other respects frequently along unexpected lines. Of the positive results already obtained the following are worthy of mention:

It has been completely demonstrated that bacteria, like plants, belong to distinct kinds, at times a little difficult to separate from each other. The opinion of certain investigators, obstinately maintained till within a year or so, and perhaps even yet by a few, that bacteria, in distinction to all other living beings, were transformable, and could take this or that morphological and biological character according to conditions, and that at most but very few varieties exist; or the hypothesis that bacteria are not independent, but belong in the development-cycle of fungi, or even algæ; or the opinion that they are but derivatives of animal cells—*e.g.*, blood-cells—an opinion still more attacking their independence: all these ideas must be abandoned in view of the overwhelming number of collected observations which without exception prove that we have to do with well-characterized varieties.

When we consider the fact that certain infectious diseases, due to bacteria, like leprosy and phthisis, had been described by the oldest medical writers in unmistakable terms, it appears that pathogenic bacteria hold their peculiar properties over long periods of time rather than that they are easily changed, as is supposed in the case of many epidemics. Within

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certain bounds there do exist variations from the usual type, especially in pathogenic organisms; but therein is a likeness to higher plants, which, owing to external influences, frequently give rise to varieties while retaining their species.

Under conditions which are unfavorable a bacterium may produce weaker forms or may lose the power to produce a color, to live in the body of animals or to form ptomaines—all of which facts interest us as physicians, although the quality lost may have little importance in the life of the bacterium. These are always but variations within certain limits, never so far removed from a middle type that we can suppose a transition—*e.g.*, of B. anthracis into B. subtilis.

Since, owing to their small size, we have no persistent morphological characters for bacteria which we can use in classifying them as we can the higher plants, it is all the more necessary that we do not hold fast by single characters which we cannot be sure are persistent or only temporary, but collect as many different observations as possible, both morphological and biological, even those which appear unimportant, and only with such a collective picture before us decide upon the species. One cannot do too much in this direction; many obscurities and contradictions in the science to-day can be referred to disregard of this rule.

A characteristic example of the difficulty of deciding to what species a particular kind belongs is found with typhoid bacilli. From mesenteric ganglia, from spleen or liver, there would be no doubt that the organisms were genuine typhoid bacilli, for in these organs none have been found which could be mistaken for them.

But great is the uncertainty when the bacilli come from intestinal contents, from earth, water, or dust. Here are numerous other bacilli to be found which resemble those of typhoid so closely that it may be impossible for a skilful bacteriologist to distinguish them. The statement, so frequently made of late, that typhoid bacilli had been found in earth, food, and drinking-water, may be accepted with reasonable doubts. Similar conditions surround diphtheria germs. Very fortunately certain important pathogenic bacilli, like those of cholera and tuberculosis, present characters which permit trustworthy recognition in even the most difficult circumstances.

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The great advantages of sure diagnosis which have followed in these two cases from knowledge of the malady's cause must be an earnest challenge to renewed efforts, in spite of all defeat, toward finding sure means of distinguishing the bacilli of diphtheria, typhoid, and other pathogenic forms; for only then can we follow them in their hidden, crooked ways outside the body and adopt a reasonable prophylaxis.

Even in the case of so well-known bacilli as those of tuberculosis, the greatest prudence is needed in estimating their distinguishing marks. These bacilli, as is well known, by staining power, by growth in pure culture, and by pathological force, and by each one of these singly, are so characterized that confusion with other kinds is out of the quesion; and yet even here all points must be considered, and only after they are found to agree should the identity of the organisms be considered proved. When I first began to experiment with tubercle bacilli, my determination was to follow this rule closely, and accordingly bacilli from different sources were examined in coloring power, growth, and pathogenic force. In the single case of chickens I could not follow my rule, as there was no fresh material from which to make cultures; but as all the other kinds of tuberculosis gave identical bacilli, and as those from chickens were similar in look and in relation to anilin colors, I thought them identical in spite of the deficiency mentioned. Later I received many pure cultures, said to be of tubercle bacilli and yet different in many respects. Experiments therewith on animals by practised and trustworthy investigators led to varying results, which even yet are unexplained contradictions. At first I considered these bacilli mere variations from unfavorable surroundings, as we frequently find them in culture outside the body. To solve the doubt, different influences were used to produce the supposed variety from ordinary tubercle bacilli. For example, they were exposed for months to high temperature, so that their growth became feeble; still higher temperature was employed repeatedly till they nearly died; chemicals, light, dryness, culture with other bacilli for many generations or in animals but little sensitive to their power—in spite of all the variations were but slight, far behind those of other bacteria similarly treated.

Thus it appears that tubercle bacilli retain their nature with the greatest obstinacy, which agrees with the fact that those

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cultivated in glasses by myself for more than nine years, without being passed through an animal in all that time, retain their characters, all but a slight loss of virulence. Since all attempts to find the connection failed, accident brought the required explanation. A year ago I received some chickens which had tuberculosis and made cultures from their organs; to my surprise these had the same appearance and other qualities of the first, which resembled real tubercle bacilli so closely. Afterward I found that these also had come from birds, but had been called genuine tubercle bacilli on the hypothesis that all forms of tubercle were identical. By Professor Maffucci's lately-published investigations on chicken-tuberculosis my observations are confirmed. I do not hesitate to pronounce the bacillus of chicken-tuberculosis a kind by itself, related to the genuine very closely, and then the question at once arises, "Is it pathogenic for man?" The answer can be given only when they are found in man, or when, in a long enough series, their absence is proved; but in every case coloring tests and culture methods must both be employed. All new experience, then, tends to make us more careful in classifying bacteria and in drawing the lines too closely rather than too far apart.

Conditions for answering other weighty questions have cleared and simplified themselves; for example, the causal relation of pathogenic bacteria and the infectious diseases.

The thought that micro-organisms must be the cause of infectious diseases very early found expression by far-seeing men singly, but the general opinion was sceptical even after the first discoveries. All the greater was the need in the first cases of convincing proof that the bacteria were the cause of the disease, not merely an accidental occurrence of disease and organism, nor yet a harmless parasite which found conditions for its growth in organs already diseased.

Many who acknowledged the pathogeny of bacteria still supposed it possible for them to become virulent only by alteration produced by the disease, from other harmless bacteria, accidentally or always present. Since, however, it has been shown—(1) that the parasite is present in every single case of the particular disease, under conditions corresponding to clinical course and pathological change; (2) that it occurs with no other disease as an incidental or harmless organism;

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(3) that when isolated from the body and artificially cultivated for a long time it can produce the disease anew—since all this is proved, the parasite can no longer be regarded as accident, but only as the cause of the disease.

This course of proof has been thoroughly carried out for a number of infectious diseases, like anthrax, tuberculosis, erysipelas, tetanus, and many diseases of animals, especially those which can be inoculated upon them. We are justified in asserting that if only the first two steps in the proof—namely, the regular and exclusive occurrence of bacteria in a particular disease—have been demonstrated, that thereby the causal connection of parasite and disease has been established. There is a third division of the proof which has not been carried out successfully with some organisms—namely, inoculation of animals; here belong typhoid, diphtheria, leprosy, relapsing fever, and Asiatic cholera. In the case of cholera all possible means have been used to disprove the pathogeny of the bacilli found, but in spite of all the fact stands fast that the cholera bacilli are the cause of cholera.

Besides these general aspects of the relation between bacteria and disease, so important on account of their applications, in other directions advance has been made, and we begin to understand how disease germs behave outside the body in water, air, and earth. It is only now, moreover, that we can decide how much we have to do with parasites which occur only in the body of men or animals, and how much with those which find their necessary conditions of life without and only occasionally produce diseases. These are matters of the highest importance for prophylaxis, for instance, in tuberculosis. The way in which bacteria enter the body has also been well explained for some of the pathogenic forms. And lastly, the behavior of pathogenic organisms within the body is better understood and many riddles of pathology solved. Here belongs the frequent appearance of combinations of two or more infectious diseases, in which one is evidently primary and the other secondary. The latter gives the real disease a different, and most often a more serious nature, or follows its as a sequel; such combinations we find in small-pox, scarlet fever, diphtheria, cholera, typhoid, and tuberculosis.

As regards the products of bacteria chemically, certain peculiar poisons which they form have been discovered which

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perhaps give rise to the most serious symptoms in the diseases they cause. Of especial interest are the poisonous albumins obtained from cultures of anthrax, diphtheria, and tetanus, the so-called toxalbumins.

The important question as to what constitutes immunity can be answered only through bacteriology, and although we are not yet ready with a solution, it still grows plainer that we have to do with chemism rather than with a strife between cells and organisms, between parasites which endeavor to penetrate the body on the one side and phagocytes on the other, which take its defence upon themselves and devour the bacilli.

Investigation has provided a large amount of material in a short time about the biology of micro-organisms, and much of this is important in medicine, such as the occurrence of persistent forms in the case of many bacteria—*e.g.*, anthrax and tetanus—which have the form of spores and an unparalleled power of resistance to high temperature and chemical agents. Also the numerous experiments on the effect of heat, cold, drying, chemicals, light, etc., on bacteria which are not pathogenic and spore-producing have given us many facts of use in prophylaxis. The influence of light is especially important. For years we have known that direct sunbeams would kill germs quickly, and I have found that tubercle bacilli live but a few minutes or hours in sunlight, according to the thickness of the exposed layer; but even dispersed daylight has the same influence, though it is slower, for cultures placed near a window die in five to seven days. For the etiology of infectious disease it is important that bacteria increase only in dampness, and cannot rise of themselves from a moist place into the air. Thus it is only mingled with dust that they are carried by air currents, and only those which live a long time in a dry state. But they never multiply in the air, as was formerly supposed.

In all the departments of the work thus far mentioned, bacteriology has fulfilled or exceeded its promises. In others the success is not so large. For instance, even improved staining methods and wider lenses show us no more of the internal structure of bacteria. But lately new coloring processes have shown a nuclear portion distinct from the plasma about it, and the locomotory organs, the cilia, more clearly

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than was possible before. In many respects, and where we would not have expected it, bacteriology has failed us; in diseases like measles, scarlatina, small-pox, etc., which from their pronounced infectious nature seemed a promising field. For none of these have we any idea of their cause, of what kind it is. Even vaccine, to be found and tried with animals at all times and places, has given no information as to its active agent, and the same is true of rabies.

Of the germ of influenza, whooping-cough, yellow fever, pleuro-pneumonia, and many other undoubtedly infectious diseases, we know nothing, although skill and patience in methods so useful in other cases have not been lacking. I am inclined to think that here we have to do not with bacteria, but organisms of a far different character. As a partial confirmation of this idea, we have in the blood of man and animals affected with malaria peculiar parasites which belong to the lowest group of animals, the protozoa. We shall know more of these parasites when we can cultivate them in artificial media and study them apart from the body. If this can be done, of which there is no doubt, a new department of bacteriology will be opened, and we may hope for light on other infectious diseases whose etiology is not yet clear.

For what good purpose is all this tiresome labor, and does it pay? Really this question should not be asked, for science should follow its way undisturbed by the demand for immediate usefulness; nevertheless, investigators have not left the idea of practical benefit out of their work, and the study of bacteriology has not been barren. Let me remind you of what has been done with disinfection, where formerly we worked in the dark and spent large sums for useless antiseptics, to say nothing of harm produced by mistaken hygiene. Now, however, we have the means of proving the efficacy of antiseptics, and though there is yet much to be done, can assert that they fulfil their purpose. Practical success is found again in water examination, where bacteriology is indispensable; and closely connected therewith are the facts obtained about the ground as a filter, and the important conclusions which follow on the use of ground water and the construction of wells. In the same way milk, as used for children, and other articles of food or use, which are exposed to infection, should be controlled. The examination of air in sewers and the

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confirmation of general ideas as to the dangers of sewer-gas, examination of air in school-rooms and discovery of bacteria in food, the ground, etc., all stand closely related to the practice of medicine. And I may mention the early diagnosis of single cases of cholera and tuberculosis as among the successes of bacteriology, the first so important for prophylaxis and the second for early treatment of the disease. All these are of indirect benefit in our contest with bacteria; direct—that is, therapeutic—measures do not equal them. The only ones to be mentioned here are the successes of Pasteur and others with protective vaccination for rabies, anthrax, charbon, etc. But even in rabies, the only one of these where inoculation may be useful to man, we do not know the exciting cause. It may not be bacterial, and consequently the success of the method cannot be claimed for bacteriology; although such discoveries have been made possible on a foundation of bacteriology.

In spite of this small result from endless research, I believe that bacteriology will yet be of the greatest service to therapeutics. In diseases of short incubation and rapid course we have least to expect, as in cholera, where the greatest emphasis must be laid upon prophylaxis. With diseases of slower course we have more opportunity for therapeutic measures, and chief among these, on account of its importance, above all other infectious diseases, stands tuberculosis. With this thought in mind I began, directly after the discovery of the tubercle bacillus, to seek for means to cure tuberculosis; and in the conviction that it can be cured I do not stand alone. Billroth has expressed himself with all distinctness in one of his latest writings to the same effect, and many are working for this end. Only it seems to me that too often a wrong way has been followed in beginning experiments with man. All that has been discovered in this way, from benzoic acid to hot air, has proved illusory. Not with man, but with the parasite itself in pure cultures, should we begin to experiment; then, when we have agents which stop the development of tubercle bacilli in cultures, we should take animals for our object of study and see whether observations made on the test-tube hold good also for a living body. Only when this is successful may we pass to man.

Following these rules, I have examined a great number of

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articles as to their influence on pure cultures of tubercle bacilli, and found that a number of them are able, even in small amount, to prevent their growth. More is not required, for it is a mistake to suppose that bacteria in the body must be killed; it is enough if we prevent their increase.

The most important substances which prevent the growth of tubercle bacilli are ethereal oils, β-naphthylamin, paratoluidin, xylidin, some of the anilin colors, like fuchsin, gentian violet, methyl blue, chinolin yellow, anilin yellow, auramin, and of the metals, mercury in vapor, gold and silver compounds. Especially powerful are the cyanide of gold combinations, which in a solution of 1:1,000,000 stop the growth of the bacilli.

All of these substances are without effect on animals affected with tuberculosis.

In spite of this failure I have not been daunted, and at last have found substances which both in the test-tube and the living body prevent the development of tubercle bacilli. All such investigations, as every one knows who has tried them, are very exhausting and slow; and my experiments with these substances, though lasting more than a year, are not yet concluded, so that all I can say at present is that Guinea-pigs, peculiarly susceptible to the disease, when exposed to the influence of the substances mentioned, cannot be inoculated with tubercle, and that Guinea-pigs which already have the disease in high degree have the malady brought to a complete stop, although the body generally suffers no ill effects from the measure.

From these experiments I will draw no other conclusions at present than that it is possible to render pathogenic bacteria within the body innocuous without ill effect upon the body itself.

If the hopes connected with this are fulfilled and we become masters of this microscopic but powerful enemy within the human body, I do not doubt that in other diseases we shall obtain the same power. Therewith is opened up a field for work, with tasks which are worthy of international competition. To give the summons to such labors was my single reason for departing from my habit of not reporting unfinished investigations.

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So let me close this address with the wish that the strength of the nations may be directed against these most minute and dangerous enemies of the human race, and that in this combat for the good of man one nation after another may be pre-eminent.

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FORMULARY OF

NEW REMEDIES

AND

NEW MEDICINAL PREPARATIONS.

BY

H. BOCQUILLON-LIMOUSIN,

Pharmacist of the First Class; Gold Medallist of the School of Pharmacy; Member of the Sociétés de Pharmacie, de Thérapeutique, et de Médecine Pratique, Paris.

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FORMULARY OF

NEW REMEDIES AND NEW MEDICINAL PREPARATIONS.

Abrus precatorius L.—Synonyms: Jequirity, liane à réglisse, réglisse sauvage, réglisse indienne.

Description.—A liana belonging to the Order of papilionaceous Leguminosæ, Genus Vicieæ. The root is long, tortuous, ramified, and ligneous. The stalk is winding, slender, and branching.

Therapeutical Properties.—Shoemaker, of Philadelphia, has successfully employed the macerated coat of jequirity seeds, applied in the form of a poultice, in several skin diseases with a tendency to ulceration.

Jequirity is chiefly used in the form of an infusion in the treatment of granular conjunctivitis. After its employment in Brazil, this infusion has been extolled in Europe by De Wecker and Stattler. They were the first to call attention to the fact that the liquid obtained from the maceration of the seeds in water produces a purulent inflammation of the conjunctiva which takes the place of the otherwise intractable granular conjunctivitis.

Bacteriological Properties.—Cornil attributes the inflammation to the action of a microbe, a bacillus present in the air which finds in the liquid a soil in which it develops and becomes virulent.

Bruylants and Venneman state that its action is due to an unorganized or zymotic ferment which they call jequirityne.

According to Béchamp and Dujardin-Beaumetz, jequirityne is a mixture of inactive legumin and a zyme—jequirityzymase.

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Use.—The infusion of jequirity is employed (ʒ iiss. of the seeds in O i. of water macerated for twenty-four hours) as a collyrium from one to three times a day until the substitutive conjunctivitis is well established. In the course of a week the cure is complete; but the infusion must always be freshly prepared, as it quickly becomes inactive.

Absinthin.—Description.—The bitter principle of wormwood which forms colorless prismatic crystals of an extremely bitter taste. It is very soluble in alcohol and chloroform, less soluble in ether, and almost insoluble in water.

Therapeutical Properties.—It has been tried, without marked success, as an antifebrile remedy. It improves the appetite or restores it when it is wanting; it counteracts constipation in a marked degree. It is used in chloro-anæmia, in the convalescence from grave diseases which have impaired the digestive functions, and in anorexia unassociated with organic lesions of the digestive canal. Absinthin is particularly indicated when anorexia coexists with more or less obstinate constipation. It is stimulant and anti-diarrhœic.

Use.—It is administered in capsules, each containing gr. ¼ of the active principle (Dr. Fernand Roux).

Dose.—Gr. iss., ten minutes after meals, twice a day.

Acalypha indica L.—Description.—Plant of the Order of Euphorbiaceæ, Tribe Jatropheæ, a native of India.

Parts Employed.—The root and leaves.

Therapeutical Properties.—Emetic, as a substitute for ipecac, and vermifuge. The decoction of the root is emeto-cathartic. According to Bidie, the juice of the leaves is used as a sure and prompt emetic in the medication of children. Like ipecac, it acts on the intestines, produces considerable depression, and increases the secretion of the pulmonary organs. In congestive hemicrania the Hindoos use it by soaking a cotton tampon in the juice of the leaves, which they insert in the nostrils. It provokes epistaxis and acts as a depletive. Bross and Langley have used it successfully in asthma and bronchitis of children.

Use and Doses.—Bidie prescribes a teaspoonful of the juice or of the decoction of the leaves as an emetic for children. Langley recommends a tincture made from ʒ iij. of the fresh plant and O iss. of ether-alcohol. The dose is from gtt. xx. to

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xxx. in honey, and must be frequently repeated. The preparation is expectorant, nauseant, and emetic, according to the dose.

Acetanilid.—Synonyms: Antifebrin, or phenylacetamide. Discovered by Gerhardt; subsequently studied by Ulrich, William, and Ch. Lauth. The formula is $C_{16}H_9NO_2$; atom. = C_8H_9NO.

Preparation.—1. Acetyl chloride or anhydrous acetic acid is made to react upon phenylamine (anilin) (Gerhardt); or, 2d, exact equivalents of phenylamine (anilin) and crystallizable acetic acid are boiled for an hour, and distilled; acetanilid sublimes at 563° F., and a quantity equal in weight to the acid employed is collected (Grésille William); or, 3d, exact equivalents of phenylacetate and phenylamine are heated and melted together for several hours.

Description.—A white substance, crystallized in magnificent lamellæ, of silky and brilliant lustre, fusible at 213.8° F. Volatilizes without decomposition at 563° F. Reaction to litmus neutral. Density lighter than water.

Insoluble in glycerin and bisulphide of carbon; slightly soluble in cold water; more soluble in boiling water; soluble in alcohol, ether, benzin, chloroform, spirit of turpentine, the essential oils, benzylic aldehyde, acetic ether, nitrous ether, sulphuric, nitric, and acetic acid (H. Bocquillon), acetone, and aldehyde.

Therapeutical Properties.—Analgesic, antinervine, antithermic.

Use.—In wafers (cachets); in solution in wine or in Garus' elixir [or any aromatic elixir.—*Transl.*].

Dose.—From gr. iv. to xxx. during twenty-four hours.

Acetyl-amidophenol.—Formula, $C_{18}H_9NO_4$.

Preparation.—1. Amidophenol is heated with acetic anhydride which produces ethenil-amidophenol; this is heated with dilute sulphuric acid and produces acethyl-amidophenol.

2. A better process consists in treating ortho-nitrophenol with tin and acetate of iron; amidophenol forms, which is heated with acetic anhydride, and then precipitated with water.

Description.—An amorphous substance, colorless or slightly reddish, difficultly soluble in water, more soluble in alcohol and concentrated acetic acid. Fuses at 393.8° F.

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Therapeutical Properties.—Recommended as an antipyretic by Hinsberg and Kost, according to whom it may be given in doses as high as gr. xxx. without danger.

Use and Doses.—In powder form. In wafers each containing from gr. iij. to viij.

Aconitum ferox Wallich.—Description.—Plant of the Order of Ranunculaceæ which grows in India and the Himalayas. The stalk is six feet high. In the Indian bazaars it is known as Bish or Bikh.

Part Employed.—The root.

Composition.—In England the root is used in the preparation of an alkaloid, English aconitine, or napelline, or pseudaconitine. Its formula is $C_{36}H_{49}NO_{12}$. Its mode of preparation is that of aconitine.

Physiological Properties.—This is one of the most poisonous alkaloids. The toxic dose would be $\frac{1}{2000}$ to $\frac{1}{1000}$ of a grain per pound of a warm-blooded animal, or about gr. $\frac{1}{12}$ for man.

Therapeutical Properties.—It is used externally in neuralgias and painful affections. Internally it is given in fevers, rheumatism, and leprosy. The tincture is employed in inflammatory diseases (pleurisy, pneumonia).

Use and Doses.—Tincture (1:10), gtt. v. to xx. Powdered root, gr. $\frac{1}{6}$ to gr. iss. Hydro-alcoholic extract, gr. $\frac{1}{12}$ to gr. $\frac{1}{3}$. Alkaloid, gr. $\frac{1}{600}$ to gr. $\frac{1}{130}$ in the twenty-four hours.

Aconitum heterophyllum Wallich.—Description.—Plant belonging to the Order of Ranunculaceæ which grows in Cashmere. In the Indian language it is called Atis.

Therapeutical Properties.—The root, unlike those of the other varieties of aconite, is not poisonous. It is employed as a tonic and antiperiodic in convalescence.

Use and Doses.—Powdered root, as a tonic, gr. iv. to viij. three times a day. As an antiperiodic, gr. xv. to xxx. every three hours.

Actinomeris helianthoides.—Synonym: Diabetes wood.

Description.—Plant belonging to the Order of Compositæ which grows in the Caucasus.

Composition.—Contains an essential oil and a peculiar resin.

Part Employed.—The root.

Therapeutical Properties.—Used in dropsy, in chronic cys-

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titis, and in vesical calculus. In Georgia it is employed in diabetes.

Use and Doses.—Ethereal tincture, ʒ i. to iss. per day. Infusion (ʒ ij. to the quart), O i. per day, in doses of fl. ʒ iv.

Adansonia digitata L.—Synonym: Baobab.

Description.—A tree belonging to the Order of Malvaceæ Tribe Bombaceæ. It is one of the largest trees known; it attains a height of fifty feet and a diameter of from twenty-five to thirty feet. The leaves fall every year and leave the tree completely bare—a rare occurrence in the tropics. In central Africa it is found from the Senegal to the Zambesi in its course through the Soudan; it grows also in Cape Verd Island, in Madagascar, and in Australia.

Therapeutical Properties.—The bark is very rich in mucilage which the negroes use as a demulcent in the treatment of inflammations of the digestive canal. The leaves are emollient and take the place of the officinal marsh-mallow. Duchassaing and Adanson recommend it for intermittent fever. The pulp which surrounds the seeds is tart and sweet, and is used in the preparation of lemonades in the treatment of dysentery. The baobab is said to be an antidote to strophanthus.

Dose.—The bark is used in fevers, in doses of ʒ i. infused in O i. of water, and taken in one day. The powdered leaves are given internally to arrest excessive perspiration.

Adhatoda vasica Nees.—Synonyms: Arusa, Indian walnut-tree, noyer des Indes.

Description.—Plant belonging to the Order of Acanthaceæ which grows in India.

Composition.—Contains a yellow coloring matter.

Parts Employed.—The leaves, roots, and flowers.

Therapeutical Properties.—Expectorant, antispasmodic, and aromatic. In asthma the leaves are smoked to mitigate the attack. The decoction is used to destroy insects and animalcules. The fresh juice is given for cough. The leaves are prescribed in consumption, to combat the cough and hectic fever.

The flowers are used for blennorrhagia. The root is exhibited in cough, asthma, fevers, and blennorrhagia. The stem is employed in chronic bronchitis and catarrhal pulmonary affections.

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Use and Doses.—Tincture, in doses of ʒ ss. to i. The aqueous extract of the leaves, gr. iv. to viij. The alcoholic extract of the leaves, in doses of gr. iij.

Adonidin.—A glucoside obtained by Vincenzo Cervello from Adonis vernalis.

Description.—A light yellow amorphous powder. It is contained in all parts of the plant.

Composition.—According to Podwissotzki, all commercial samples of adonidin examined by him were mixtures containing more or less of the active principle together with other constituents of the plant. Among the latter he has discovered and described: adonido-quercitrin, of an orange color; adonido-dulcite, a sugar crystallizing in handsome prisms; an inactive amorphous glucoside, and adonidic acid. The chemically pure active principle, which he calls picro-adonidin, is an amorphous glucoside of an extremely bitter taste, easily soluble in water and alcohol and quite soluble in ether.

Physiological Properties.—According to the mode of preparation, it appears to have given variable results in the hands of different experimenters. Some have found its action uncertain and inconstant; others have obtained very satisfactory results.

Therapeutical Properties.—The drug was first tried by Bubnow and later by Huchard. Administered in doses of from ⅓ to ½ grain, it raises the arterial tension, regulates and slows the heart beats, augments diuresis, and disperses dropsies and œdemas. As it is rapidly eliminated, it does not accumulate in the system, like digitalis. It is indicated in aortic affections, in arterio-sclerosis, and in the first stage of interstitial nephritis.

Use and Doses.—From gr. $\frac{1}{12}$ to gr. $\frac{1}{6}$ per day, in granules.

Adonis vernalis L.—Description.—A plant belonging to the Order of Ranunculaceæ.

Therapeutical Properties.—It was employed, in 1879, by Bubnow in the treatment of cardiac affections. Bubnow's experiments have been repeated in France by Lesage, Mordagne, Huchard, Eloy, and Dujardin-Beaumetz. The various preparations act upon the heart like digitalis, regulating the action of the organ and increasing the arterial pressure. It is a diuretic and causes thrice the usual quantity of urine to be ex-

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creted. It has the advantage over digitalis that it does not accumulate in the system.

Use and Doses.—Infusion (℥ v. of the stems and leaves to O i. of water), fl. ℥ vi. in twenty-four hours. Aqueous extract, gr. xv. per day. Tincture, ʒ i. to ij.

Agaricin.—The active principle of agaric.

Description.—It crystallizes in long needles.

Therapeutical Properties.—This drug does not cause diarrhœa, and it has been observed that cough is less frequent and sleep more quiet during the nights when it has been taken.

Doses.—From gr. $\frac{1}{12}$ to gr. $\frac{1}{8}$ five or six hours before the time when the night sweat generally occurs. The dose is the same for hypodermic injection. Dr. Seifert uses the following solution for hypodermic injection.

℞ Agaricini, ... gr. $\frac{3}{4}$
Alcohol absolut., ... ♏ lxxx.
Glycerini, ... fl. ʒ i.

This a 0.5% solution; one syringeful is injected five hours before the usual occurrence of the sweat.

Internally, in pill form:

℞ Agaricini, ... gr. viij.
Pulveris Doveri, ... ʒ ij.
Pulveris althææ, ... ʒ i.
Mucilaginis tragacanthæ, . . . ʒ i.
M. ft. pilulæ No. c. Two to be taken every day.

Dr. Seifert, of Wurtzburg, has given it in pills containing gr. $\frac{1}{12}$, one or two at a dose, for the night sweat of phthisis, with good results. As the drug does not act before the lapse of five or six hours, it must be given six hours before the usual onset of the sweat. If this symptom occur twice every night, one pill is to be taken six hours before each attack.

Agaricus giganteus.—Synonym: Polyporus senex.

Description.—A fungus found on the coasts of Chili.

Therapeutical Properties.—Remarkable absorbent properties are attributed to it. Grossi has used it as a styptic and considers it a specific in hemorrhages due to injured arteries which are too small to be ligated and too large to be treated by other styptics.

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℞ Polyporus senex, ... gr. iij.
Sodii bicarbonatis, ... gr. xiv.
Aquæ destillatæ, ... fl. ʒ iij.
Pulveris acaciæ, ... ʒ i.

Three teaspoonfuls to be taken during the night.

Agaricus muscarius.—Composition.—The fungus furnishes a non-crystallizable alkaloid, muscarine, $C_5H_{18}NO_2$.

Therapeutical Properties.—The salts of muscarine, the sulphate and the nitrate, are used in practice. The drug produces purgation, salivation, and perspiration. It is an antidote to atropine, but the latter is a virulent poison.

The plant has also been tried in epilepsy. In Siberia, despite the efforts of the government, it is used in the preparation of a narcotic beverage.

Dose.—From gr. $\frac{1}{60}$ to gr. $\frac{1}{3}$.

Agave americana.—Synonym: American aloe.

Description.—A plant belonging to the Order of Liliaceæ-Amarylleæ which grows in North America and Mexico.

Part Employed.—The leaves.

Therapeutical Properties.—Diuretic; antisyphilitic. It is used in the preparation of an alcoholic beverage, a kind of antiscorbutic beer; but its abuse causes cutaneous eruptions.

Use and Doses.—Tincture (1:5). Fluid extract in doses of ʒ ss. to ʒ i.

Alaninate of Mercury.—Synonym: Amido-propionate of mercury.

Preparation.—Alanin or amido-propionic acid, $C_6H_7NO_4$, is dissolved in twenty parts of distilled water, brought to ebullition, and gradually saturated with powdered red oxide of mercury; it is then filtered, concentrated, and allowed to crystallize.

Description.—A white crystalline powder, soluble in thrice its weight of water; the solution is colorless and does not change under the influence of light and air; it is a good antisyphilitic and is well borne by the patients.

Therapeutical Properties.—Its use leads to recovery in from four to six weeks; it produces no stomatitis.

Use.—The solution is administered, either by the mouth or hypodermically.

Doses.—By the mouth, $\frac{1}{30}$ to $\frac{1}{12}$ gr. per day for children.

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By hypodermic injection, gr. $\frac{1}{32}$ to gr. $\frac{1}{12}$ for children. De Luca exhibits it to adults in doses of gr. $\frac{1}{12}$ to gr. $\frac{1}{4}$ hypodermically.

Albuminate of Mercury (*dry*).—Preparation.—Into a filtered solution of albumen (1:8) pour a 4% solution of bichloride of mercury, in the proportion of scant 36 parts of mercury to 100 parts of albumen, so that the filtered liquid contains a slight excess of albumen. Let it stand at rest until the precipitate is formed (48 hours), decant, and mix the precipitate, without washing, with enough milk sugar to form an almost dry powder. Hasten the drying in a desiccator with sulphuric acid, and add enough milk sugar to make the whole contain 0.4% of corrosive sublimate. ʒ iij. of albumen, ʒ i. of sublimate, and 2½ pounds of milk sugar will furnish about 2¾ pounds (troy) of albuminate.

Aletris farinosa L.—Description.—A plant belonging to the Order of Liliaceæ, perennial, herbaceous, with non-bulbous rhizomes, indigenous to North America.

Part Employed.—The rhizome.

Description.—It contains a bitter principle, insoluble in water, but very soluble in alcohol.

Therapeutical Properties.—Has been successfully employed in America in dropsy and in chronic rheumatism. A bitter tonic in small doses; emeto-cathartic in large doses. Tonic to the uterine system.

Use.—Tincture. Powder. Alkaloid. Fluid extract.

Doses.—Tincture, ʒ ij. Powder, gr. ix. as a bitter tonic. The alkaloid, aletrine, is prescribed in doses of gr. ss. Fluid extract, gtt. iij. to gtt. x. Decoction (℥ i. to O ij. of water), in doses of fl. ʒ i.

Algarrobo (*blanco*).—Synonym: Prosopis alba L.

Description.—A plant belonging to the Order of papilionaceous Leguminosæ, growing along the La Plata. It has a bitter taste and an odor like that of fenugreek.

Therapeutical Properties.—It is used in South America in the treatment of catarrhal affections.

Use and Doses.—Decoction (℥ i. to O ij. of water), in doses of fl. ʒ iv.

Allamanda cathartica L.—Description.—A plant belong-

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ing to the Order of Apocynaceæ, indigenous to Guiana and Brazil.

Composition.—Contains a milky juice.

Parts Employed.—The bark of the stalk and the juice.

Therapeutical Properties.—The juice is cathartic in small doses, and poisonous. Desportes recommends the extract from the bark as a hydragogue. Allamand employed the juice to overcome the constipation due to lead-poisoning. The infusion of the leaves is a very good cathartic.

Use and Doses.—Aqueous extract, in doses of from gr. i. to gr. ij. The juice, in doses of from gtt. viij. to gtt. x. Infusion of the leaves (℥ iiss. to O ij. of water).

Alstonia constricta Mueller.—Description.—A plant belonging to the Order of Apocynaceæ, indigenous to Australia. Its bark is suberous and resembles that of the elm; it is soft and bitter.

Composition.—The active principles are located in the deeper portions of the bark which are close together, paler, and very bitter. Hesse has extracted from it alstonine, a bitter alkaloid; a flesh-colored substance, porphyrosine; an amorphous white body, porphyrine; and another alkaloid, alstonidine.

Therapeutical Properties.—This bark, on account of its bitterness, possesses very marked tonic and digestive properties. It seems to act in a similar manner as gentian. Besides, it is astringent, anthelmintic, and antiperiodic. It is employed in dysentery, in diarrhœa, and in debility.

Use and Doses.—Powder, in gr. viij. doses. Tincture, ℥ i. to ℥ ij. per day.

Alstonia scholaris R. Br.—Synonyms: Echites scholaris L., Dita.

Description.—A plant belonging to the Order of Apocynaceæ, Tribe Plumiereæ. It is found on Java and the Philippine islands. The milky juice of the tree has the same properties as caoutchouc; it softens in hot water and is soluble in turpentine and chloroform.

Part Employed.—The bark.

Composition.—Hesse and Jobst have derived from it:

1. Ditamine, $C_{16}H_{19}NO_2$, an amorphous bitter alkaloid, soluble in alcohol, ether, and chloroform.

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2. Echitamine, $C_{22}H_{26}N_2O_4$, HO, a crystalline alkaloid, soluble in water, alcohol, ether, and chloroform.

3. Echitenin, $C_{20}H_{27}NO_4$, amorphous, bitter, slightly soluble in water, soluble in alcohol and ether.

4. A neutral substance, echicerin.

Therapeutical Properties.—Tonic, anthelmintic, and febrifuge; it has also been proposed as a substitute for quinine. It has been prescribed in chronic diarrhœa, dysentery, and the debility consequent on fevers, with a view to re-establish the digestive functions.

Besides, the bark is antiperiodic, antiseptic, stimulant to the nervous system, combining the properties of both quinine and strychnine. It is given in typhoid and puerperal fevers.

Use and Doses.—The powdered bark, gr. v. Tincture (1 : 10), ♏ xviij. to ♏ lxxij. Infusion of the bark (ʒ ss. in fl. ʒ x.), fl. ʒ i. to fl. ʒ ij., three times a day.

Alvelos.—Synonym: Alvelos milk.

Description.—The milky and resinous juice of Euphorbia heterodoxa Muller, belonging to the Order of Euphorbiaceæ, indigenous to the province of Pernambuco, Brazil.

Preparation.—It is obtained by expression in the form of a milky juice, of a yellowish-white color and syrupy consistence, insoluble in water and alcohol, soluble in ether and chloroform, miscible with fixed oils. In Europe, samples of good quality resemble light-colored butter and have the consistence of vaselin.

Therapeutical Properties.—According to Vellosa, it is a specific in cancerous ulcers, chancres, tumors, sarcomas, and ulcers of every description. It has cured some grave cases of lupus.

Duploy has obtained good results in cancer and malignant tumors.

Landowsky has tried it in cancroids, epitheliomas, and syphilitic vegetations, and accords to it a powerful escharotic effect, together with a solvent action on organic tissues. It combines the effects of a caustic with that of papaine. According to some, it imparts a pronounced color and a disagreeable odor to the urine.

Contra-indications.—Its internal use is contra-indicated,

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owing to its caustic action and its irritant effect on the renal parenchyma.

Use.—The cancer is painted with alvelos which is allowed to dry and, after two hours, charpie is applied; the next day it is washed with a solution of carbolic acid and alvelos reapplied; the operation is repeated until the cure is complete. Landowsky applies it with a brush and dresses with borated vaselin. The drug is also employed in the form of alvelos plasters which are very active vesicants.

Ambrosia artemisifolia L.—Description.—A plant indigenous to the southern United States, flowering toward the middle of August.

Therapeutical Properties.—In Maryland it is used in fevers as a substitute for quinine. It is a popular remedy for epistaxis, and according to Hill it arrests hæmoptysis. In a case of grave purpura in a child of six years, the effusion of blood was arrested by giving to the patient, at first every half-hour, and later at longer intervals, fl. ʒ ss. of a decoction made from a handful of the plant to fl. ʒ v. of boiling water.

Anagyrine.—An alkaloid first isolated by E. Hardy and N. Gallois in 1885. The formula is $C_{14}H_{18}N_2O_2$.

Preparation.—The bruised seeds of Anagyris fœtida are macerated in cold water, the macerate is precipitated with basic acetate of lead and decomposed with hydrogen sulphide; the solution is concentrated and bichloride of mercury added, by which the anagyrine is precipitated. The precipitate is collected and decomposed with hydrogen sulphide. The liquid is concentrated, then saturated with potassium carbonate, and repeatedly shaken with chloroform; then the chloroform is shaken with water acidulated with hydrochloric acid until exhausted. On evaporation the solutions deposit the hydrochlorate of anagyrine in a crystalline form.

The hydrochlorate of anagyrine thus obtained is soluble in water. The solution is decomposed with potassium carbonate, shaken with alcohol, the alcohol decanted and saturated with a current of carbonic acid which precipitates the potassium, and the filtered solution, on evaporation, furnishes anagyrine which needs only be recrystallized from absolute alcohol to be obtained pure.

Description.—An amorphous substance having a yellowish

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tinge, soluble in water, alcohol, and ether. Freely exposed to the air it deliquesces and acquires a viscous consistence. It combines with acids to form crystalline salts. The precipitate with iodide of mercury and iodide of potassium is white; with iodine in potassium iodide, brown; it also precipitates bichloride of mercury, chloride of gold, chloride of platinum, etc.

Physiological Properties.—A poisonous substance. Hardy and Gallois have begun to study the physiological action of hydrochlorate of anagyrine, at first with Bochefontaine, then with Gley. The general phenomena which they have witnessed in warm-blooded animals are almost the same as those observed by Arnoux with extract of anagyris: vomiting, chills with trembling, slowing of the respiratory movements, and finally arrest of respiration and of the action of the heart.

In the frog, the most striking phenomenon is the abolition of muscular movement; the heart-beats persist long after all other movements have ceased.

Anagyris fœtida L.—Synonym: Stinkweed.

Description.—A shrub four to six feet high, belonging to Order of papilionaceous Leguminosæ. Its habitat is central France, Italy, Greece, and Algeria; it exhales one of the most disagreeable fetid odors which is most pronounced in the bark and which is communicated to the milk of animals browsing on its leaves.

Therapeutical Properties.—Purgative, like senna.

Use and Doses.—An infusion of from ʒ iv. to ʒ ss. of the leaves may be given as a gentle purgative.

Anchietea salutaris.—Synonym: Cipo summa.

Description.—A plant belonging to the Order of Violaceæ, indigenous to Brazil.

Composition.—Contains an alkaloid, anchietine (Peckolt), insoluble in water and ether, soluble in alcohol, crystallizes in yellow needles.

Therapeutical Properties.—Peckolt prescribes a decoction in syphilis, herpes, and cutaneous eruptions, and a syrup in whooping cough. The plant causes abundant salivation. The root is purgative.

Use and Doses.—Powder, gr. ij. to gr. vi., two or three times a day. Decoction, ʒ i. in O i. of water. Alcoholic ex-

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tract, gr. $\frac{1}{8}$ to gr. iss., three times a day. Syrup (℥ i. of the tincture, fl. ℥ i. of simple syrup), three times a day.

Anda Assu.—Synonyms: Anda açu, Anda Gomesii A. Jus., Johannesia princeps Velloz., Coco purgatif.

Description.—A tree belonging to the Order of Euphorbiaceæ, Tribe Jatropheæ, quite common in Brazil, in the province of Rio.

Composition.—The seeds contain 14% of a pale yellow, transparent, drying oil, in consistence like olive oil, odorless, of a nauseous and acrid taste; soluble in ether and benzin; solidifies at 46° F.; density, 0.917.

They contain 0.4% of a crystalline substance, johannesine, isolated by Oliveira, slightly soluble in water, soluble in alcohol, insoluble in ether and chloroform.

Therapeutical Properties.—The oil is purgative, like castor oil, but in a dose three or four times smaller; it is more fluid, easier to take, and odorless.

Johannesine is not poisonous, as has been believed.

The sulphate and the hydrochlorate of johannesine are used as diuretics in doses of gr. xv. The seeds may also be used as any effective purgative in diseases of the liver, jaundice, dropsy, menstrual disorders, and scrofulous affections.

Use.—After discarding the embryos and episperms, the seeds are made into an emulsion which is flavored to lessen the tendency to cause vomiting.

Doses.—Oil, fl. ℥ iij. Of the seeds, for an adult, two, rarely three. They act in two or three hours, without irritating the stomach or intestines.

Andira inermis H. B.—Synonyms: Geoffroya inermis Sw., Cabbage-tree, Angelim.

Description.—A tree belonging to the Order of Leguminosæ, Tribe Dalbergieæ, which grows in the Antilles, in Guiana, and Senegal.

The active portion of the bark is grayish externally, and the color of iron internally; it is several millimetres in thickness, of a sweet and mucilaginous taste, and a disagreeable odor; it has been studied by Duquid.

Therapeutical Properties.—This bark has well-established anthelmintic properties and is also slightly narcotic. In large doses it causes violent evacuations, fever, and delirium which

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are treated with castor oil or lemon juice. It is also effective in obesity.

Use and Doses. — Decoction (℥ i. in O ij. of water), 4 tablespoonfuls, 2 tablespoonfuls for children. The dose is increased until nausea ensues. Powdered bark, from gr. xviij. to xxviij. as a vermifuge, and gr. xxviij. to xliij. as a purgative. Tincture (1 : 5) ranges in dose, according to the effect to be produced, from gtt. xvi. to fl. ʒ i. Fluid extract, ♏ xvi. to ♏ xxxv.

Andrographis paniculata Wall.—Synonyms: Justicia paniculata Burm., Kariyat.

Description.—An herbaceous annual, belonging to the Order of Acanthaceæ, indigenous to India, Ceylon, Cochin-China, and the Indian archipelago.

Composition.—It contains a bitter principle.

Parts Employed.—The stalk and the adhering roots.

Therapeutical Properties.—Tonic, bitter and stomachic, similar to quassia; it is recommended in general debility, in the convalescence after fevers, and in the advanced stage of dysentery; used as a stimulant in dyspepsia.

Use and Doses.—Infusion, made from kariyat, bruised, ℥ ss., in boiling water, fl. ℥ x. From fl. ℥ iss. to ij., two or three times a day.

Tincture, containing

Kariyat root, ...	℥ vi.
Myrrh, ...	℥ i.
Alcohol, 80%, ...	O ij.

From ʒ i. to ℥ ss.

Anemone Pulsatilla L. — Synonyms: Rose-campion, Pasque-flower, Passe-fleur, Fleur de Pâques.

Description.—An annual belonging to the Order of Ranunculaceæ, common all over Europe.

Composition.—When the comminuted plant is distilled in a current of steam, a liquid is obtained, from which a solid substance is extracted with chloroform; this body is anemone camphor (Hanriot). This substance is easily split up into anemonin and anemonic acid.

Anemonin ($C_{15}H_{12}O_6$) crystallizes in needles, has an acrid taste, is slightly soluble in water and ether, soluble in alcohol and chloroform. It melts at 313° F. Alkalies convert it into

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anemonic acid ($C_{15}H_{14}O_7$), which is amorphous, forms amorphous salts, and is insoluble in water, alcohol, and ether.

Therapeutical Properties.—When fresh it is one of the most dangerous poisons and, therefore, must be handled with caution. Externally, the fresh leaves might be useful as rubefacients or even as vesicants.

When dried, anemone is indicated as an anti-catarrhal remedy and as exercising a special effect on the nervous system and on the heart. Externally it is applied for stubborn eruptions.

The tincture from the root is prescribed in catarrhal fever, nasal hypersecretion, and coryza.

It is also used in paralysis and whooping cough.

It rapidly mitigates the pain in blennorrhagic orchitis. Borcherin reports more than twenty-four cases of acute epididymitis, all uncomplicated, treated with tincture of anemone pulsatilla, in doses of two drops every two hours. The patients were not kept in bed, but the wearing of a suspensory is indispensable. The drug manifests its good effects in the first three days of the treatment. The irritant action of the plant is due to the anemone camphor; this action disappears after desiccation, as the camphor is split up into anemonin and anemonic acid.

Use and Doses.—The powdered leaves. Tincture, gtt. xx. to gtt. xxx. in a potion. Alcoholate of the root, ʒ ss.–i. per day, in fl. ℥ iv. of julep, three spoonfuls per day. Alcoholate of the leaves, fl. ʒ iss.–iij. Syrup of the alcoholate (5:95), each tablespoonful contains gtt. xxx. of the alcoholate. Alkaloid, anemonine, gr. ⅓–⅔. P. Vigier says that gr. iss. may be taken without inconvenience.

Anisic Acid.—An isomer of methylsalicylic acid.

Preparation.—It is obtained by oxidation of essence of anise.

Description.—It is slightly soluble in water, very soluble in alcohol and ether. The alkaline salts formed by this acid, however, are very soluble in water.

Bacteriological Properties.—Has very pronounced antiseptic properties. Sprinkled in powder over a wound, it dries up the pus and arrests the development of micro-organisms.

Anisate of sodium has been proposed in surgical practice owing to its antiseptic power, and in the treatment of articular rheumatism as a substitute for salicylate of sodium (Curci).

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Annidaline (*Iodized Phenols*).—A product obtained in the reactions between the compounds of the phenol group and iodine in presence of an alkali, the nature of which has been studied by Messinger and Vortmann.

Preparation.—If we add a solution of iodine in iodide of potassium to an alkaline solution of phenol, in the proportion of 8 atoms of iodine to 1 molecule of phenol and 4 of hydrate of potassium, and heat the mixture to 112–140° F., a dark red precipitate is produced, whose composition is that of an iodide of diiodophenol ($C_6H_3I_8OI$), which seems to be isomeric with white triiodophenol, previously known, and into which it is easily converted by being boiled in a potassium solution and reprecipitated by an acid. When dry, the new product is violaceous, odorless, soluble in alcohol to which it imparts a red color, and easily soluble in benzol and chloroform.

The cresols give analogous compounds; thymol combines in the proportion of two molecules to three atoms of iodide: this is probably a triiodide of dithymol. When freshly prepared it is red and retains that color for several months if kept dry and excluded from light. In damp air it readily decomposes, giving up its iodine and becoming pale yellow; in this condition it is a diiodide of dithymol. Resorcin under this treatment furnishes an iodide of diiodoresorcin.

Description.—Amorphous, insoluble in water, readily soluble in alcohol, and slightly soluble in ether and chloroform.

Therapeutical Properties.—It is recommended as a substitute for iodoform.

Anogeissus latifolius.—Description.—Plant belonging to the Order of Combretaceæ, indigenous to the Senegal and India.

Composition.—Produces a gum known as Dhaura.

Therapeutical Properties.—Furnishes a mucilage which is stable when acidified and has the same medico-pharmaceutical uses as gum acacia.

Anona muricata L.—Synonyms: Custard apple, Sour Sap.

Description.—A tree or shrub belonging to the Order of Anonaceæ, indigenous to tropical America, mainly the Antilles. The fruit is a large ovoid berry, green or yellowish, covered with straight spines. The bark has a resinous odor and a disagreeable taste. The pulp is white and butyraceous, its

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odor resembles that of the pine-apple or cinnamon, and it has a pleasant taste. The fruit may weigh as much as sixteen pounds. The expressed juice ferments and furnishes an alcoholic liquor which sours readily.

Therapeutical Properties.—The fruits, when ripe, are antiscorbutic. In a green state, dried and reduced to powder, they are employed in dysentery. The flowers are expectorant, the leaves are antispasmodic, the seeds are emetic. The decoction of the root is an antidote against narcotic poisoning. Finally, the entire fruit destroys vermin and drives away flies and mosquitoes.

Antiaris toxicaria Lesch.—Synonym: Upas Antiar.

Description.—A tree belonging to the Order of Artocarpeæ, which attains a height of one hundred feet and a circumference of nine to twelve feet; its habitat is Java, Sumatra, and Cochin-China, where the natives use it to poison their arrows for the chase or for war. To prepare the poison, incisions are made in the trunk and a milky, viscous sap is collected; to this other plant juices and powders are added, such as those of pepper and garlic. When the poison is prepared, it is quickly filled into bamboo receptacles, as it changes in the air.

Composition.—It contains resins and a glucoside, antiarin, which crystallizes in lamellæ and is decomposed by acids into resin and glucose.

Therapeutical Properties.—Injected hypodermically, antiarin, which is very poisonous, acts upon the heart like digitaline and aconitine.

Taken internally, however, it is merely evacuant. Placed in contact with the skin, it causes pain.

The seeds, which are very bitter and contain no antiarin, have been recommended for dysentery and diarrhœa.

The principles contained by the plant are too poisonous to be used in ordinary practice.

Antipyrine.—An artificial alkaloid discovered by Knorr, which has taken a prominent place in therapeutics.

Synonyms.—Dimethyloxyquinizine, methylated oxymethylquinizine, analgesine, or according to the constitution now recognized, dimethylphenylpyrazolone. Formula, $C_{20}H_{10}N_2O_2$.

Preparation.—Phenylhydrazine is made to react upon acetylacetic ether, forming oxymethylquinizine. This substance

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is subjected to the action of a mixture of iodide of methyl and methyl alcohol; the result is dimethyloxyquinizine. The product of this reaction is decolorized with sulphurous acid, precipitated with sodium, and purified by repeated crystallization from ether.

Description.—A stable white substance in brilliant crystalline lamellæ, odorless, fusing at 233.6° F. Freely soluble in water, alcohol, benzin, chloroform, and glycerin; slightly soluble in ether.

With perchloride of iron it gives a blood-red color (characteristic); with nitrous acid a bluish-green color.

Physiological Properties.—A quantity of ʒ i. to ʒ iv. taken in divided doses at hourly intervals markedly reduces the temperature for from five to ten hours or longer. Its toxic property is slight, for it requires about gr. xij. per pound of an animal's weight to produce symptoms of poisoning. In large doses it may cause a scarlatiniform eruption.

According to A. Robin, it reduces the quantity of nitrogen in the urine and diminishes the sulphuric acid in the system; it increases the phosphoric acid in the urine. Owing to its influence on the nervous system, antipyrine reduces tissue waste. It markedly slows the circulation and the pulse becomes less frequent.

Therapeutical Properties.—According to the experiments of Filehne of Erlangen, Ernst of Zurich, and Huchard, Dujardin-Beaumetz, Féréol, Cadet de Gassicourt, and Germain Sée in France, it possesses antipyretic and analgesic properties in a high degree.

It has been recommended in many affections. It moderates nervous activity and calms pain. Hence it may be employed in cases in which nervous excitability must be curbed (migraine, neuralgia, diabetes, chorea, pain), or in which tissue metabolism and waste must be lessened (phthisis).

According to the experiments of Hénocque and Moncorvo, it possesses hemostatic powers superior to those of perchloride of iron and ergotin, and this effect is manifested with surprising rapidity; they cite some cases of injuries, epistaxis, and ulcers in which antipyrine in 10% solution or in substance, dusted over the surface, has given the best results.

It has been successfully employed in the uric acid diathesis and especially in rheumatism.

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The preparations of caffeine and quinine are rendered more soluble by it.

Use.—It may be administered in solution and its taste masked by bitter orange peel, or by being inclosed in wafers containing from gr. viij. to gr. xv.

Doses.—As an antipyretic, gr. viij. to gr. xv. at once, dose to be repeated every four hours not to exceed gr. xlv. in twenty-four hours. As a styptic, gr. xv. as a suppository with cacao butter, q. s. As an analgesic, ʒ ss. to ℈ iv. in doses of gr. xv. For hypodermic injection, gr. iv. to gr. viij. in ♏ xvi. of liquid.

Incompatibles.—Salicylate of sodium, naphthol, and chloral, which form liquid mixtures.

Antirrhinum majus L.—Synonym: Snap-dragon.

Description.—A plant belonging to the Order of Scrofulariaceæ, found all over Europe, India, North and South America.

Composition.—Contains a glucoside, rhinanthin (Phipson). The leaves are macerated in cold water for several days; the macerate is filtered, precipitated with subacetate of lead, again filtered, the excess of lead separated, and the solution evaporated to a syrupy consistence. After some days, the rhinanthin is found in brilliant rhombic crystals, which have a sweet though acrid taste and are soluble in water and alcohol.

Therapeutical Properties.—The drug is employed as a resolvent and emollient. The seeds furnish an oil used for food.

Antisepsis and *Antiseptics.*—Antisepsis is a method which aims at the destruction or arrest of development of the micro-organisms infecting the system.

Antiseptics are the microbicide agents.

Antisepsis must be distinguished from Asepsis (which see).

General and Special Antisepsis.—General antisepsis is performed when the aim is the destruction of all microbes, without any distinction; on the other hand, special antisepsis is effected in certain cases where substances are employed which act specially on a particular microbe.

Antiseptic power of Drugs.—Miquel has made use of beef broth sown with atmospheric germs or full-grown bacilli, and varied the antiseptic substance in quantity until the liquid remained indefinitely free from putrescence. He found:

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1. Extremely Antiseptic Substances:

Oxygenated water,	gr. ¾
Corrosive sublimate,	gr. i.
Nitrate of silver,	gr. i.¼

2. Very strongly Antiseptic Substances:

Iodine,	gr. iv.
Chloride of gold,	gr. iv.
Chloride of platinum,	gr. ivss.
Hydrocyanic acid,	gr. vi.
Bromine,	gr. ix.
Sulphate of copper,	gr. xvi.

3. Strongly Antiseptic Substances:

Cyanide of potassium,	gr. xviij.
Bichromate of potassium,	gr. xviij.
Ammonia gas,	gr. xviij.
Chloride of aluminum,	gr. xxi.
Chloroform,	gr. xxiv.
Chloride of zinc,	gr. xxix.
Thymol,	ʒ ss.
Chloride of lead,	ʒ ss.
Nitrate of cobalt,	gr. xxxiiss.
Sulphate of nickel,	gr. xxxviiiss.
Nitrate of uranium,	gr. xliij.
Phenic acid,	gr. 50.
Permanganate of potassium,	gr. lv.
Nitrate of lead,	gr. lvi.
Alum,	gr. lxx.
Tannin,	gr. lxxiv.

4. Moderately Antiseptic Substances:

Hydrobromate of quinine,	gr. lxxxv.
Arsenious acid,	ʒ iss.
Sulphate of strychnine,	☽ vss.
Boric acid,	gr. cxv.
Arsenite of sodium,	☽ vij.
Hydrate of chloral,	ʒ iiss.
Salicylate of sodium,	ʒ iiss.
Ferrous sulphate,	ʒ iij.
Caustic soda,	ʒ ivss.

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5. Feebly antiseptic Substances:

Perchloride of manganese,	℥ viss.
Chloride of calcium,	℥ i.¼
Borate of sodium,	℥ ii.¼
Hydrochlorate of morphine,	℥ iiss.
Chloride of strontium,	℥ ii.¾
Chloride of sodium,	℥ ii.⅞
Chloride of barium,	℥ iij.
Alcohol, pure,	℥ iij.

6. Very feebly Antiseptic Substances:

Chloride of ammonium,	℥ iii.¾
Arseniate of potassium,	℥ iv.
Iodide of potassium,	℥ v.
Sea salt,	℥ vss.
Glycerin,	℥ vii.¼
Sulphate of ammonium,	℥ viij.
Hyposulphite of sodium,	℥ ix.

The proportion indicated is the minimum dose. These figures apply to the spores of bacteria and not to those of fungi. The vapors of iodine, bromine, chlorine, hydrogen, carbon, sulphur, and nitric acid act upon atmospheric germs in a period of time which varies from several hours to six days.

Liquid Antiseptics:

Phenic acid,	2.5%
Corrosive sublimate,	0.10%
Hydrate of chloral,	0.10%
Boric acid,	3.10%
Salol collodion,	10%
Salol ether,	10%
Hyposulphite of sodium,	5%

Antisepsis, Medical.—The antiseptics most commonly employed in ordinary medical practice are the following:

Sublimate.—Solution 1:1,000.

Bichloride of mercury,	gr. xv.
Alcohol,	fl. ℥ iiiss.
Distilled water,	q. s. ad O ij.

Used almost exclusively for the irrigation of wounds and of the pleura in purulent pleuritis.

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Phenol [Carbolic Acid].—Solution 1:40.

Phenol liq.,	fl. ʒ vi.
Alcohol,	fl. ℥ i.
Water,	q. s. ad O ij.

Generally used for furuncles, anthrax, and abscess.

Solution for internal use.

Water,	fl. ℥ xxxiij.
Phenol, cryst.,	gr. xv.

Used as a gastric and an intestinal antiseptic.

Boric acid.—Solution 1:40.

Used for irrigating the mouth, the bladder, and the pleura.

Camphorated naphthol, camphor and naphthol, equal parts. —Tried by Périer and Fernet, in whose hands it has given good results in ulcerations of the cervix uteri, and in diphtheria.

Tannin.—Five-per-cent solution.

Recommended as a wash for ozæna, and internally in tuberculosis.

Nitrate of Silver.—Gr. viiss. to xv. in fl. ℥ iiiss.

Successfully employed in purulent ophthalmia neonatorum.

Salol.—Used internally, in wafers, for flatulence of the stomach and typhoid fever.

Hydrate of Chloral.—

Chloral hydrate,	gr. xv.
Distilled water,	q. s. ad fl. ℥ iiiss.

For irrigation of the pleura after empyema, and for painting of gangrenous and fetid wounds.

Hyposulphite of sodium, 5%.

Used in vaginal injections for metritis, vaginitis, and cancer of the uterus.

Naphthol, beta.—Used in connection with salicylate of bismuth for intestinal antisepsis, according to Bouchard.

Naphthol, beta,	gr. iv.
Salicylate of bismuth,	gr. xv.–xxx.

Another solution:

Naphthol, beta,	ʒ iv.
Alcohol,	fl. ℥ i.½
Water,	fl. ℥ ij.

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Fernet injects fl. 3 vi. of this solution into the pleura in purulent pleuritis.

Camphorated Phenol (equal parts).—Used in diphtheria.

Saccharin.—In 1% solution, for blennorrhagia.

Permanganate of potassium.—In 1% solution, for blennorrhagia.

Resorcin.—In 2% solution, for blennorrhagia.

Glycerin solutions.—The preceding aqueous solutions may be replaced by the following solutions made with glycerin.

Phenol, 1 part;	Glycerin, 4 parts.
Tannin, 1 part;	Glycerin, 4 parts.
Gallic acid, 1 part;	Glycerin, 4 parts.
Alum, 1 part;	Glycerin, 5 parts.
Boric acid, 1 part;	Glycerin, 5 parts.
Borax, 1 part;	Glycerin, 5 parts.

In preparing the glycerin solution of borax, 3 parts of water must be added.

Antisepsis, Surgical.—The antiseptics most commonly employed in surgery are the following:

Phenol [Carbolic Acid].—Strong solution, 1:20.

Phenol liq.,	fl. ʒ i.¼
Alcohol,	fl. ʒ ij.
Distilled water,	q. s. ad O ij.

The solution is colored red with fuchsine.

Used for washing the field of operation and the wound before the suture.

Weak solution, 1:40.

Phenol liq.,	fl. ʒ vi.
Alcohol,	fl. ʒ i.
Distilled water,	q. s. ad O ij.

Used as an antiseptic bath in whitlow and contused wounds.

Concentrated solution, 70:100.

Phenol,	ʒ ii.¼
Alcohol,	q. s. ad fl. ʒ iv.

Used for the disinfection of surgical instruments.

Carbolated oil, 1:10.

Phenol,	ʒ iiss.
Oil of sweet almonds,	q. s. ad fl. ʒ iv.

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Used for the preservation of catgut or the disinfection of sounds.

Boric Acid.—Solution 1:40.

Boric acid, ...	ʒ x.
Distilled water (hot), . . .	q. s. ad O ij.

Used exclusively in the surgery of infants and in ophthalmology.

Biniodide of Mercury.—Solution 1:2,000. Used especially in obstetrics for intra-uterine injections.

Bichloride of Mercury.—Solution 1:1,000.

Used for the irrigation of wounds, and in the personal antisepsis of the surgeon and his assistants; must not be used for the disinfection of metallic instruments.

Camphorated naphthol.—Naphthol and camphor, equal parts.

Employed by Perier as a powerful antiseptic.

Salol.—Employed directly on wounds and ulcerations, being dusted over them.

Chloride of zinc.—Solution 1:100.

Chloride of zinc, ...	ʒ v.
Water, ...	q. s. ad O ij.

Used for washing operating rooms.

Iodoform.—The powdered drug is applied directly to the wound.

In cases of cold abscesses, a solution of iodoform in ether is injected.

Iodoform, ...	ʒ iiss.
Ether, ...	q. s. ad fl. ℥ iv.

Permanganate of Potassium.—Solution 1:100. Used for washing fetid wounds.

Carbolated Oil.—Used for burns.

Among the pharmaceutical preparations should be mentioned:

Absorbent Cotton.—This is prepared by treating cotton alternately with hydrochloric acid and soda; it is then washed in an abundant amount of water, and finally with distilled water until the wash water no longer precipitates nitrate of silver; it is then dried.

Used for dressings and may take the place of sponges.

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Antiseptic Gauze.—This is prepared by treating commercial gauze-muslin in the same manner.

Absorbent cotton and gauze serve as a basis for antiseptic preparations.

It suffices to impregnate them with a weighed antiseptic solution and drying them at the ordinary temperature. In this way the following cottons and gauzes are prepared:

Carbolated, 5%.
Salicylated, 5% and 10%.
Iodoformed, 5%, 10%, and 50%.
With biniodide of mercury, 0.5%.
With tannin, 33%.
Camphorated, 30%.
With sal alembroth [mercuric and ammonium chloride], 2%.
With iodine, 6%.
With salol, 5%.
Sublimated, 1%.
With salicylic acid and camphor, 10%.
Borated, 5%.
With alum, 30%.
With perchloride of iron, 5%.
With eucalyptol, 5%.
With thymol, 3%.

Catgut.—

Phenic acid, in concentrated surgical solution,	q.v.
Oil of juniper,	q.v.
Chromic acid,	1%
Boric acid,	40%
Iodoform,	5%
Alum,	30%

Antiseptic Sponges.—The selected sponges are immersed in a solution of permanganate of potassium until they have acquired a dark brown tint; removed from this bath, they are plunged into a concentrated solution of sulphite or hyposulphite of sodium to which hydrochloric acid is added. Under the influence of the sulphurous acid gas and the hydrochloric acid the sponges are bleached, then they are washed in large quantities of antiseptic water, and at length they are preserved in carbolic acid solution or in Van Swieten's solution.

Antithermin.—Synonym: Phenylhydrazin-levulinic acid.

Preparation.—It is obtained by the combination of levulinic or aceto-propionic acid with phenylhydrazin. The anhydride of this acid, which is the only one employed, is prepared by heating the acid to 338° F.

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Therapeutical Properties.—Antithermic, analgesic, antiseptic, and febrifuge.

Use and Doses.—In wafers (cachets) in doses of gr. iv.–viij.

Apocynum cannabinum.—Synonyms: Canadian hemp, dog's bane.

Description.—A plant belonging to the Order of Apocynaceæ, indigenous to North America, from the Carolinas to Hudson's Bay.

Composition.—Schmiedeberg and Lavater have separated from it two substances belonging to the category of cardiac medicaments and which they have named apocynin and apocynein.

Apocynin, in small doses, arrests the heart of frogs in systole.

Apocynein may be compared with digitaline, both as regards its chemical properties and its physiological action.

Therapeutical Properties.—In the United States, the root is employed, in the form of a decoction, as a diuretic and diaphoretic in dropsy. In large doses it acts as an emeto-cathartic. It is also a vermifuge. It is given in dyspepsia, scrofula, and rheumatism. The fresh plant contains a milky sap which inflames mucous membranes. The whole plant sometimes poisons water courses.

Use and Doses.—Tincture (1:10), gtt. v.–xl. Powder, gr. ss.–i. Tincture (1:5), ʒ i. Decoction, ʒ iiss. in fl. ℥ viij. of water.

Apone.—Synonym: Concentrated tincture of capsicum.

Preparation.—The drug is prepared from Capsicum annuum or frutescens, belonging to the Order of Solanaceæ.

Therapeutical Properties.—Used externally; revulsive and epispastic, recommended by V. Poulet for articular rheumatism and phlegmasia, in frictions.

Internally, it is used for hemorrhoids. It increases the flow of the gastric and intestinal juices and stimulates the peristaltic movements of the intestines. It is very useful in atonic dyspepsia and mania.

Use and Doses.—Simple tincture:

Powdered capsicum, ...	gr. xv.
Alcohol, 80%, ...	fl. ʒ vij.

Macerate for eight days, express, and filter.

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Concentrated tincture:

Powdered capsicum,	℥ v.
Alcohol, 90%,	q. s.

Macerate for twenty-four hours, and by percolation obtain oz. xxix. of product.

The tincture is painted with a brush over the parts where rubefaction is desired. Internally, gtt. iij.-x. for dyspepsia and mania, and gtt. x.-xx. for hemorrhoids.

Araroba.—Synonym: Goa powder. Limousin was the first to give its history.

The drug comes from Bahia (Brazil).

It is found in the fissures of a tree named Angelim amargosa or Andira Araroba, belonging to the Order of Leguminosæ.

Composition.—Limousin has isolated from it chrysarobin, which is not identical with, but closely related to chrysophanic acid.

Therapeutical Properties.—Has been used with good effect in herpes circinatus, psoriasis, and other cutaneous affections.

Use and Doses.—Ointment, ℥ i.-ij. of the powder to ℥ i. of lard and glycerin.

Arbutin.—Formula, $C_{25}H_{34}O_{14}$.

Description.—A glucoside derived from Arbutus Uva Ursi, a plant belonging to the Order of Ericaceæ. It is soluble in water and alcohol.

Therapeutical Properties.—Employed in vesical catarrh. The plant is diuretic.

Use and Doses.—In potion, wafers, or pills, in doses of gr. xv.-xlv. in twenty-four hours.

Arctium Lappa L.—Synonym: Burdock.

Description.—A plant belonging to the Order of Compositæ-Cynareæ, indigenous to Europe.

Composition.—Said to contain an alkaloid, lappine (Welher); also tannin.

Parts Employed.—The seeds and roots.

Therapeutical Properties.—Stimulant, in dyspepsia.

Has been used with good effect in skin diseases, chiefly inveterate and intractable psoriasis.

The root is sudorific and diuretic.

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The tincture from the root is used in diseases of the heart and in rheumatism.

Use and Doses.—Tincture from the seeds, fl. ʒ i., three times a day, in psoriasis; ʒ v. twice a day, in dyspepsia. Tincture from the root, in doses of ♏ xvi. to fl. ʒ iij. in rheumatism.

Areca.—Description.—A nut derived from Areca Catechu L., belonging to the Order of Palmaceæ, indigenous to Indian archipelago and India.

Composition.—Bombelon has found three alkaloids: one of these, arecaline, presents some analogies with pelletierine and is tænicide; another, arecaine, is toxic and produces effects resembling those of muscarine.

Therapeutical Properties.—Chewed with betel leaves and lime it constitutes a masticatory largely used in India. In England it has been employed as a tænifuge, but cannot be relied upon.

Use and Doses.—The powdered nut, in doses of ʒ ss. to ʒ vi., is mixed with milk. Egasse advises not to exceed the dose of ʒ ij., as the toxicity of arecaine may prove dangerous.

Aristol.—Synonym: Biniodide of dithymol.

Preparation.—It is obtained by treating a solution of iodine in iodide of potassium with thymol dissolved in caustic soda. A reddish-brown precipitate is formed—aristol, which is insoluble in water, slightly soluble in alcohol, and soluble in ether.

Therapeutical Properties.—Recommended by Erchoff and Boymond as a substitute for iodoform. Void of bad effects and odor, it acts energetically in skin diseases such as psoriasis; it does not color the skin and causes no conjunctivitis. On wounds and burns its effects are very good.

Use and Doses.—As a liniment mixed with oil. As an ointment with vaselin, of 10% strength. Powdered aristol is also used topically by being sprinkled over wounds.

Asclepias tuberosa.—Description.—A plant belonging to the Order of Asclepiadaceæ, indigenous to the United States, from Massachusetts to Georgia.

Part Employed.—The root.

Therapeutical Properties.—It is diaphoretic and expectorant, without being stimulant. In large doses it possesses cathartic properties. It is employed in local congestions, in

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bronchitis, catarrh, pneumonia, pleurisy, diarrhœa, acute and chronic rheumatism.

Use and Doses.—Powder, ℈ i. to ʒ i., several times a day. Fluid extract, ♏ xxx. to fl. ʒ ij.

Asepsis and *Aseptics.*—Asepsis is the group of measures taken to avoid the inoculation of operation wounds with infectious germs.

It consists particularly in extreme cleanliness, not only of the field of operation, but also of the surgeon, assistants, instruments, dressings, etc.

Aseptics, such as the boiled water employed in abdominal surgery, are deprived of septic products, but have no microbicide power; this is what distinguishes them from antiseptics (which see).

The surgical operation comprises three successive steps: preparation, operation, dressing.

Preparatory Asepsis.—This consists in rendering the field of operation, the instruments, the hands of the surgeon and his assistants aseptic.

Asepsis of the Field of Operation.—Shaving the hairs from the parts adjoining the wound; washing and brushing of the field of operation with warm water and soap; washing with an antiseptic solution, usually sublimate 1:1,000. Isolation of the field of operation by compresses saturated with antiseptic solution.

Asepsis of the Instruments.—Measures for disinfecting the instruments: washing, brushing.

Flaming.—Difficulty in employing it for the disinfection of certain instruments.

Boiling Water.—At 212° F. all the germs are not destroyed, as the spores are more resistant. Hence the boiling point of water has been elevated by the addition, for example, of chloride of calcium.

Most Steam under Pressure, at 230° F.—The most resistant micro-organisms are completely destroyed if subjected for half an hour to moist steam at 230°.

Usually the instruments, after having been washed and brushed with sterilized warm water, are immersed in a strong carbolic solution.

Asepsis of the Surgeon.—Minute cleanliness of the hands,

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nails, and the forearm to the elbow. The surgeon, after having wetted his hands in 1:1,000 sublimate solution, operates with bare arms and hands continually moist; he avoids touching his apron, the clothes, or any of the surrounding objects; during the operation he dips his hands several times in the antiseptic solution.

Asepsis of the Dressings.—The same minute care must be bestowed upon the dressings. The several portions are generally impregnated with antiseptic substances, but this is not enough; the dressings must also be *kept* aseptic, that is to say, all septic germs must be prevented from touching them.

Aseptol.—Synonyms: Sulphobenzidic acid, ortho-oxyphenylsulphurous acid, sozolic acid, sulpho-carbol.

Preparation.—A mixture of sulphuric and phenic acid, after having been left in contact for several weeks.

Description.—A syrupy liquid, sp. gr. 1.400; crystallizes in small deliquescent needles; decomposes when distilled.

It is less poisonous than phenic acid and has a more agreeable odor. It is very soluble in water.

Therapeutical Properties.—It is but slightly caustic, is not irritating, and its use can be continued for some length of time in affections of the skin, of the eys, and of the bladder. Being but slightly poisonous, it may be used internally in relatively large doses, as well as in concentrated solution in the treatment of pharyngitis and diphtheritic laryngitis. Internally it may take the place of salicylic acid, to which it is superior by reason of its solubility.

Use and Doses.—Internally, Vigier recommends a lemonade, in the proportion of 3 iss. of sozolic acid to O ij. of water. Externally, a solution of from 1 to 10%.

Asimina triloba Dun.—Synonym: Anona triloba L.

Description.—A shrub belonging to the Order of Anonaceæ, indigenous to North America.

Composition.—Contains an alkaloid, asiminine (Lloyd), insoluble in water, soluble in alcohol and ether, bearing some resemblance to morphine in its reactions.

Parts Employed.—The leaves and seeds.

Therapeutical Properties.—The pounded leaves are used to hasten the cicatrization of wounds. The seeds are antipsoric. According to Bartholow, asiminine is a local anæsthetic and

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possesses a powerful sedative action which is preceded by a period of excitement. It retards the action of the heart without weakening it.

Asteracantha longifolia Nees.—Synonym: Hygrophila spinosa And.

Description.—A plant belonging to the Order of Acanthaceæ, indigenous to Malabar, India.

Therapeutical Properties.—The root is a powerful diuretic, employed with good results in dropsy, gravel, and anasarca.

The seeds are diuretic, aphrodisiac, and contain a large amount of mucilage.

Use and Doses.—Concentrated infusion (1:7), in doses of ♏ xxx. to fl. ʒ iss. Decoction (ʒ ij. : fl. ʒ xx. of water), dose half a teacupful.

Astragalus mollissimus L.—Synonyms: Crazy weed, loco weed.

Description.—A plant belonging to the Order of Leguminosæ, indigenous to Texas.

Composition.—Contains a peculiar acid and a resin.

Therapeutical Properties.—Kennedy found that this plant improves the appetite. It was reputed to render men insane and to cause bloating in animals, but these assertions have not been scientifically proven.

Atherosperma moschata Labill.—Synonym: Australian sassafras.

Description.—A plant belonging to the Order of Meliaceæ, indigenous to Australia and Tasmania.

Part Employed.—The bark, which is used as a tea by the Australians.

Therapeutical Properties.—Diaphoretic and diuretic, used in asthma and other pulmonic affections and some diseases of the heart. The decoction is tonic and antiscorbutic.

Use and Doses.—Tincture (1:10), gtt. xxx. to ʒ i. per day. Essential oil, gtt. i. to gtt. iij. every six hours.

Azadirachta indica Juss., *Melia Azadirachta* L.—Synonyms: Indian lilac, false sycamore.

Description.—A plant belonging to the Order of Meliaceæ, indigenous to India and China.

Therapeutical Properties.—Seeds, emetic; bark, antiputrid,

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bitter, anthelmintic, stimulant; oil from the seeds, antirheumatic. It is used in pernicious and intermittent fevers, in debility, and in long convalescences.

Use and Doses.—Tincture, as a tonic, ʒ ss.–ij. per day; as an antiperiodic, ʒ i. every two hours before the attack. Decoction, as an antiperiodic, fl. ℥ ss.–i., every two hours before the expected attack; as a tonic, ♏ viij. three times a day.

Ballota suaveolens L.—Description.—A plant belonging to the Order of Labiatæ, indigenous to the Antilles and India.

Therapeutical Properties.—Boivin claims this to be one of the best nervines to be employed in the large class of visceral and nervous disorders. A physician who has long resided in the Antilles recommends it as a remedy that will dissolve stone and evacuate gravel and partially dissolved calculus. It is a powerful diuretic and a sedative to the urinary passages. It eliminates morbid material from the blood. It may be used as a depurative and laxative.

Use.—It is mixed with lemon and honey.

Bambusa arundinacea Wild.—Description.—A plant belonging to the Order of Graminaceæ, derived from India.

Part Employed.—A concretion found on the joints of old stems, called tabaschir.

Therapeutical Properties.—Tonic, aphrodisiac, and pectoral.

Baptisia tinctoria R. Br.—Synonyms: Sophora tinctoria L., wild indigo.

Description.—A plant belonging to the Order of Leguminosæ, indigenous to the United States.

Composition.—Contains three principles:

Baptisin, a bitter glucoside;

Baptin, a purgative glucoside;

Baptitoxine, a very poisonous alkaloid, acting similarly to curare.

Therapeutical Properties.—In large doses it is emetocathartic; in moderate doses, laxative. It is used in scarlet and typhoid fevers, in gangrene, and in putrid angina. Stevens has employed it successfully in dysentery.

"Baptisin" is an American remedy, obtained by precipitating the tincture of Baptisia tinctoria with water. It is used

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as an antiseptic, alterative, tonic, laxative, emetic, according to the dose; in affections of the liver and erysipelas; it may produce abortion.

Use and Doses.—Decoction, ʒ i. in fl. ʒ xx. of water. Baptisin, gr. ⅛ as a tonic; gr. iss. as a laxative; gr. iij. as an emetic. Fluid extract, fl. ʒ i. to fl. ʒ ss. Tincture (1:5), ♏ xxv. to fl. ʒ i.

Barbasco.—Synonym: Clibadium biocarpum.

Description.—A plant belonging to the Order of Compositæ Synantheræ-Senecionidæ, indigenous to the province of Mexico and to Venezuela.

Part Employed.—The stalk of the plant.

Composition.—Contains an alkaloid.

Therapeutical Properties.—It is a very strong poison. It is used as a hair wash, to restore the natural color. The stalks, which have an irritant action, are used by the inhabitants in diseases of the eyes.

Bela.—Synonyms: Bael; Bengal quince.

Description.—The half-ripe, desiccated fruit of Ægle Marmelos, belonging to the Order of Aurantiaceæ.

The fruit is a berry the size of a large orange, almost spherical, but flattened at the extremities; it is covered with a firm rind, and is divided into ten or fifteen compartments which contain, besides the seeds, a very tenacious mucilage which, when dried, is hard and transparent.

Therapeutical Properties.—The leaves are anti-asthmatic.

The fruit is very astringent to the taste, and the pulp becomes mucilaginous on coming in contact with the air; its astringent properties render it useful in diarrhœa, dysentery, and atony of the intestines; it cures without causing constipation.

Use and Doses.—It is given in doses of ʒ i.–ij., every two or three hours. The British Pharmacopœia directs a fluid extract, the dose of which is ʒ i.–ij.

In British India a decoction is employed:

Bael fruit, dried, ...	ʒ ij.
Water, ...	fl. ʒ xx.

which is boiled down to fl. ʒ iv.

Belladonnine.—From the syrupy mother-water left after

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the preparation of atropine, which furnishes no crystalline products.

Composition.—According to Dürkopf, these mother-waters contain belladonnine, hyoscyamine, and hyoscine, together with the decomposition products, tropine, pseudo-tropine, and tropic acid. The presence of hyoscine was demonstrated as follows: On digesting the crude belladonnine in acid solution with ether and chloroform, and on heating the purified basic substance with appropriate reagents to split the atropine into tropine and tropic acid, the hyoscine (15 to 20%) remains in solution, leaving the belladonnine unaltered. The hyoscine is easily separated in the form of gold salts.

Benzanilid.—Preparation.—This compound results from the action of benzoyl chloride upon anilin, or of benzoic acid upon anilin, in equivalent proportions at the boiling point. Its formula is $C_6H_5CO—NH—C_6H_5$.

Description.—A white crystalline powder, insoluble in water, soluble in alcohol (58 parts of alcohol at 68° F., and 7 parts of boiling alcohol), difficultly soluble in ether.

Therapeutical Properties.—Kahn has obtained good results with it as an antipyretic in the treatment of children. According to experiments made with the series of anilids, the only active ones are benzanilid, acetanilid, and salicylanilid; and benzanilid has proved superior by the absence of bad after-effects.

Doses.—It is administered to children in doses of gr. ij.–x.

Berberine.—Description.—Berberine combines with its solvents, forming crystalline compounds; this is the case, for example, with alcohol, ether, acetone, and chloroform; with the latter, a beautifully crystalline body is obtained, remaining stable even at 212° F. These crystals are composed of one molecule of berberine and one molecule of chloroform (Schmitt).

Berberis asiatica Roxb.—Description.—A plant belonging to the Order of Berberidaceæ.

Therapeutical Properties.—The bark is tonic, diaphoretic, and antiperiodic.

Composition.—The bark contains berberine and oxyacanthine.

Use and Doses.—Tincture of the bark (1:5), ʒ iiss.–v. In-

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fusion, fl. ℥ i.–iij., two or three times a day. Extract, gr. xv.–xxx.

Berberis Lycium Roy.—Synonym: Rusot.

Description.—A plant belonging to the Order of Berberidaceæ.

Therapeutical Properties.—The bark is tonic, antiperiodic, and diaphoretic. It is prescribed in intermittent and remittent fevers and in general debility. The extract of the bark has long been in use for ophthalmia.

Use and Doses.—The drug is mixed with equal parts of alum and opium, to which is added sufficient lemon juice to reduce it to the consistence of cream, when the eyelids of the affected eye are coated with it. Infusion of the bark (℥ ss. : water, fl. ℥ x.), three times a day. Tincture, as an antiperiodic, fl. ʒ iij.–vi.; as a tonic, ♏ xxx. to fl. ʒ iiss.

Betol.—Preparation.—It is obtained by the reaction between beta-naphthol and salicylic acid in presence of a dehydrating agent, such as oxychloride of phosphorus. Chemically it plays the part of an ether analogue of salol.

Description.—Soluble in oils and alcohol; it melts at 203° F.

Therapeutical Properties.—Antiseptic and antipyretic, recommended for cystitis, vesical catarrh, articular rheumatism, instead of salicylate of sodium and carbolic acid, owing to its relative innocuousness.

Doses.—Gr. ivss.–viij.

Biniodide of Mercury.—Preparation.—It is obtained by precipitating a solution of sublimate by a solution of iodide of potassium, none of the constituents employed being in excess.

Therapeutical Properties.—A very powerful antiseptic and an energetic antisyphilitic. Recommended by Panas in ophthalmological practice, and by Porak and Auvard in gynecology.

Use and Doses.—Solution:

Biniodide of mercury, ...	gr. $\frac{1}{12}$.
Alcohol, ...	fl. ʒ vi.
Water, ...	fl. ℥ iij.

For atomization, a solution of gr. xv. of the biniodide, gr. xv. of iodide of potassium, and O ij. of water, for use in phthisis. These atomizations act favorably on the patient, by diminish-

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ing the expectoration and sterilizing the microbes ("Archives de Pharmacie").

Bituminate of Iodoform.—Preparation.—Tar is mixed with iodoform in the proportion of ten to twenty parts of iodoform to one hundred parts of tar.

Description.—The product has a bronze color, a distinct odor of tar, and is free from the disagreeable odor of iodoform.

Therapeutical Properties.—This product possesses all the antiseptic properties of iodoform. Ehrmann has used it in soft chancres with good results.

Use.—It is applied like an ointment, and the dressing is covered with oiled silk.

Boerhavia diffusa L.—Synonym: Ipecac.

Description.—A plant belonging to the Order of Nyctaginaceæ.

Therapeutical Properties.—Laxative and stomachic, used in jaundice, ascites, retention of urine, internal inflammations, gout and rheumatism, anasarca, and renal insufficiency. It is administered as an expectorant in asthma. It is also emetic.

Use.—Infusion, in teaspoonful doses.

Boldo.—Synonyms: Boldoa fragrans, Peumus Boldus Mol.

Description.—A plant belonging to the Order of Monimiaceæ, derived from Chili.

Physiological Properties.—On the nervous system it exerts a hypnotic effect; this predominant action is associated with a certain degree of anæsthesia; the somnolent state is preceded by a motor inco-ordination analogous to that of drunkenness; the glucoside of boldo calms and regulates the respiratory and cardiac movements; it produces a slight lowering of the temperature; it has a stimulant effect on the various secretions, especially those of the liver and kidneys; given by the stomach in certain doses it may cause nausea and vomiting. The fatal toxic effects which require very large doses— ʒ iiss.-iiiss. for a dog weighing eighteen to twenty-four pounds—manifest themselves by a temporary and progressive suspension of the respiratory movements which occurs during a quiet and uninterrupted sleep (Laborde).

Therapeutical Properties.—Indicated in cases where it is necessary to overcome insomnia and secure quiet sleep. It is

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largely employed in atony of the different organs when quinine is not tolerated, also in torpid liver, rheumatism, dyspepsis, gonorrhœa, chronic vesical catarrh; finally, as it is balsamic and carminative, it is useful in abscess of the liver, after the fever has ceased. The leaves are digestive, carminative, and diaphoretic.

Doses.—Tincture (1:5), gtt. xx.–xxx., three times a day. Fluid extract, gtt. i.–v. Wine (3 parts of the leaves in fl. ℥ iij. of Madeira), one dessertspoonful. Leaves, ʒ ij.–℥ ss. Boldine (soporific), ʒ i.–ij.

Bonduc.—Synonyms: Cæsalpinia Bonducella Flem., Guilandina Bonducella L.

Description.—A plant belonging to the Order of Leguminosæ-Cæsalpinieæ, indigenous to Africa, Asia, and tropical America.

Part Employed.—The seeds.

Composition.—Contains a resin, named bonducin, which is the active principle.

Therapeutical Properties.—This drug, mixed with castor oil, is used in the treatment of hydrocele. It is said to be tonic and antiperiodic; often it acts as quickly as quinine.

Use and Doses.—The seeds are given in doses of gr. viij.–xij., twice a day. Tincture (1:5), gtt. xxx. Compound powder of bonduc and black pepper, gr. xv.–xxx., three times a day. Bonducin, gr. iss.–iij.

Borates of the Alkaloids.—Definite combinations formed by boric acid with the majority of alkaloids.

Preparation.—The following mode of procedure may be used:

The alkaloid (eserine, pilocarpine, atropine, hyoscyamine, cocaine, etc.) is dissolved in a small quantity of alcohol; on the other hand, in the same vehicle twice the weight of the alkaloid employed of boric acid is dissolved; the two solutions are mixed, and evaporated to dryness.

The products thus obtained are not true salts, but contain, each, just one-third of the respective alkaloids; they are very soluble in water, and have an alkaline reaction which suffices to prevent their becoming irritating when serving as a basis for collyria (A. Petit).

Therapeutical Properties.—The least acidity irritates the

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eye, hence the desire to obtain absolutely neutral alkaloidal salts for collyria. Some are decidedly acid, like nitrate of pilocarpine, hence their solutions are made freely alkaline by the addition of an excess of the base. This addition is easy in the case of pilocarpine which is very soluble in water. Though but slightly soluble, eserine, atropine, hyoscyamine, dubosine, when triturated in water, impart to it a very distinct alkalinity, by which the above inconvenience is obviated. But to use the alkaloids in the form of borates is a better way.

The biborates are still more distinctly alkaline, and the small quantity of alkaloid displaced by the decomposition, as in the case of atropine and its isomers, as well as of cocaine, sets free a minute quantity of boric acid which will always be saturated, owing to the excess of alkalinity due to the alkaloid.

Even should some boric acid become free, which could not occur unless a notable portion of the alkaloid of the collyrium be decomposed, or if sufficient boric acid be added to render the saturation of the alkalinity almost complete, the small proportion of free boric acid could not have the irritant effect of hydrochloric, nitric, or sulphuric acid which, under like conditions, would appear in the collyria in general use.

Borate of Ammonium.—Therapeutical Properties.—Professor Laskevich ascribes a great value to this salt in the treatment of phthisis. It diminishes expectoration and frequently lowers the pyrexia in the first stage of the disease. It may be combined with sedatives, opium, or henbane.

Doses.—Internally, gr. xv.–3 i. According to Laskevich the daily dose is gr. iv., three times a day. Externally, 3 ss.–iiss.

Borate of Bismuth.—Description.—An insoluble, yellowish-white salt.

Preparation.—Obtained by heating to the melting point a mixture of acid nitrate of bismuth and boric acid.

Therapeutical Properties.—The same as those of subnitrate of bismuth.

Use and Doses.—The impalpable powder, in the same doses as the subnitrate (Delpech).

Borate of Chinoidine.—Preparation.—A combination of crude chinoidine with boric acid.

Description.—An amorphous, yellowish powder, soluble in

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three parts of cold water, which renders this solution preferable to that of sulphate of quinine for hypodermic injection.

Composition.—Contains 54% of chinoidine.

Doses.—Gr. xv. of borate of chinoidine are equivalent to gr. x. of sulphate of quinine.

Borate of Quinine, amorphous.—Description.—An almost crystalline powder, of an amber-yellow color, with a pronounced but not disagreeable odor, and bitter taste, but less so than hydrochlorate of quinine. It dissolves in about an equal weight of water.

Therapeutical Properties.—The daily ingestion of gr. viij.–xv., continued for weeks, never causes untoward symptoms in the digestive apparatus; it lowers the temperature slowly and gradually.

Doses.—Given in doses of gr. viij.–xv. repeated every half-hour or hour, until a maximum of gr. xlv. in two to four hours is reached. It may also be given hypodermically.

Boussingaultia baselloides.—Description.—A plant belonging to the Order of Chenopodiaceæ-Basellaceæ, indigenous to South America.

Part Employed.—The root.

Therapeutical Properties.—An energetic styptic, in cases of uterine hemorrhage after delivery.

Use and Doses.—Decoction, ℥ iij. of the root in O i. of water, a small teacupful three times a day in grave cases; once only, at night, in ordinary cases.

Bromide of Arsenic.—Preparation.—Metallic arsenic is made to react on bromine dissolved in bisulphide of carbon, in the proportion of ten parts of arsenic to thirty-two parts of bromine. When the reaction is complete and the mixture has cooled, the bisulphide of carbon is expelled by distillation or evaporation.

Description.—A crystalline solid, of a pale yellow color; it melts at 77° F. and volatilizes at 428° F. The formula is $AsBr_3$. It is very hygroscopic and decomposes on contact with water.

Therapeutical Properties.—In Germany and the United States it is highly appreciated, as combining the action of arsenic with that of bromine.

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Use and Doses.—Clemens' solution, analogous to Fowler's solution, is prepared and given in doses of gtt. v.–xx. It may be given in capsules with ether, each containing gr. $\frac{1}{30}$, in progressive doses from one to five.

Bromide of Gold.—Therapeutical Properties.—Used in epilepsy and migraine. It is better tolerated than the other bromides.

Doses.—Gr. $\frac{1}{8}$ to $\frac{1}{4}$ for adults; gr. $\frac{1}{20}$ to $\frac{1}{10}$ for children.

Bromide of Nickel.—Therapeutical Properties.—A salt recommended for epilepsy.

Use.—Pills, and syrup.

Dose.—Gr. ss.–i.

Bromoform.—$CHBr_3$.

Preparation.—It is obtained by treating alcohol or acetone with bromated lime [the compound corresponding to chlorinated lime or chloride of lime].

Description.—A colorless liquid. It dissolves with difficulty in cold water, easily in warm water, alcohol, and ether.

Physiological Properties.—It produces anæsthesia, but in a less degree than chloroform, without giving rise to vomiting. The period of excitement is less pronounced and the anæsthesia of shorter duration.

Bromoform is an anæsthetic and hypnotic agent. By prolonging the inhalation, animals may be kept asleep as long as desired, without fear that respiratory or circulatory troubles will arise (Henocque).

Three operations have been performed on patients anæsthetized with bromoform, and no untoward accident occurred, either during or after the administration.

Children anæsthetized with bromoform eat on awaking, and soon after fall asleep, without evincing any discomfort.

Bacteriological Properties.—It is strongly antiseptic. A one-per-cent solution kills the bacteria.

Therapeutical Properties.—The drug exerts an irritant effect on the conjunctival and laryngo-pharyngeal mucous membranes. Stepp has employed it in seventy cases of whooping cough and, from a prophylactic point of view, has obtained good results.

Use and Doses.—Gr. iss.–ivss. for children; gr. xv.–xxiv. for adults.

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Stepp recommends a daily dose, according to age, of from gtt. v.–xx., in the following form:

Bromoform, ...	gtt. x.
Alcohol, ...	fl. ʒ i.–iss.
Water, ...	fl. ℥ iij.
Syrup, ...	fl. ʒ ij.

One to two teaspoonfuls every hour.

The bromoform solution is taken with avidity by children, despite its strong odor.

In order to obtain lasting results, it must be administered regularly, in doses corresponding to the age of the patient and the gravity of the case.

Buchinka.—Synonym: Momordica operculata L.

Description.—A climbing plant, belonging to the Order of Cucurbitaceæ, indigenous to Brazil.

Therapeutical Properties.—The fruit, deprived of the rind and parenchyma by maceration in water, is used as an energetic, drastic purgative.

Use and Doses.—Powder, gr. viij.–xv.

Butea frondosa Roxb.—Description. —A tree belonging to the Order of Leguminosæ, Tribe Papilionaceæ, which furnishes the so-called Butea or Bengal kino.

Therapeutical Properties.—The seeds are aperient and anthelmintic when given in honey. Externally, mixed with astringents and salt, they clear up leucomata of the cornea. Mixed with lemon juice, they are useful in herpes and scabies. The leaves are astringent, tonic, aphrodisiac, and effective in burns and acne. They are also used internally in flatulent colic, worms, and hemorrhoids. The flowers are astringent, depurative, diuretic, and aphrodisiac; applied in cataplasms, they cause the absorption of small tumors, restore the menses, and increase diuresis.

The gum of the tree is astringent and is recommended for pterygium and corneal opacities.

Dose.—The dose of the powdered seeds is one tablespoonful, twice a day, as a vermifuge.

Butyl-Chloral.—Synonym: Croton chloral.—Formula, $C_4H_5Cl_3O$. A substance discovered by Kramer and Pinner.

Preparation.—It is obtained by passing a current of chlo-

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rine into aldehyde, kept in the beginning in a refrigerating mixture. The action, at first very violent, subsequently becomes less intense, and toward the end of the operation the temperature must be raised to 212° F. Abundant fumes of hydrochloric acid are continually given off. When the operation is concluded, the liquid is subjected to fractional distillation; the product distilling between 315 and 329° F. is collected; this is butyl-chloral. An indispensable condition of success is to have the chlorine always in excess, until its action is exhausted.

Description.—Anhydrous butyl-chloral is an oleaginous, colorless liquid, with a peculiar odor recalling that of chloral. Though insoluble in water, it combines with it and forms a hydrate crystallizing in nacreous flakes. This hydrate is but slightly soluble in water at ordinary temperatures; it dissolves more freely in warm water and in glycerin, and abundantly in alcohol. Thus its properties are a counterpart of those of chloral; the resemblance goes much further, for as ordinary chloral in presence of potassa decomposes into chloroform and formate of potassium, butyl-chloral under the same conditions gives allyl-chloroform and formate of potassium.

Physiological Properties.—Internally administered, butyl-chloral rapidly induces sleep, like its congener; but, according to O. Liebreich, it has the great advantage of never retarding the pulse or the respiration.

The same author also accords to butyl-chloral absolute innocuousness as regards the stomach and other organs.

Therapeutical Properties.—O. Liebreich considers it one of the most efficacious remedies against facial neuralgia, the pain ceasing quite frequently before sleep is induced.

In France, butyl-chloral has been studied and tried by Worms and Weill at the Jewish Hospital, and by Bouchut at the Children's Hospital. The two former have confirmed the correctness of the facts stated by Liebreich with regard to its action, and Bouchut concludes thus: "Butyl-chloral can be administered to persons who simply need sleep; but if anæsthesia is desired it must be set aside."

In equal doses, butyl-chloral is inferior to chloral and less active.

According to these investigators, neuralgic pains dependent upon the fifth pair are suppressed by this agent.

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Use and Doses.—Potions, pills, and enemata. Subcutaneously it causes abscesses. Solution:

Butyl-chloral hydrate, ...	℥ iiss.
Alcohol, ...	fl. ʒ iij.
Glycerin, ...	fl. ʒ iv.
Distilled water, ...	fl. ℥ iv.

One tablespoonful of this solution contains about gr. xv. of butyl-chloral. One or two spoonfuls are given each day, for facial neuralgia.

Cactus grandiflorus L.—Description.—A plant belonging to the Order of Cactaceæ.

Therapeutical Properties.—Exhibited for palpitation of the heart.

Use.—Tincture (1:5), gtt. i.–v., three times a day. Fluid extract, gtt. i.–iij.

Caffeine.—Synonym: Theine. Discovered by Runge. Formula, $C_8H_{10}N_4O_2$.

Description.—The alkaloid of coffee and tea, also found in the kola nut and in guarana; fuses at 356° F., sublimes at 363° F. Forms unstable salts, citrate, lactate, malate, valerianate, benzoate, and salicylate of caffeine.

Phenate of caffeine, obtained by mixing exact equivalents of caffeine and phenol, is said to be a true crystalline combination which is very soluble in water and causes no irritation of the mucous membranes.

Physiological Properties.—Has been used as an anæsthetic by Leed who dissolves by heat gr. ij. of caffeine in fl. ℥ ij. of alcohol and water.

In large doses (gr. ivss.–viiss.) it produces some symptoms of nervous and vascular excitement; in small doses it causes slight drowsiness, followed by some circulatory stimulation which favors the exercise of the animal functions.

Therapeutical Properties.—Huchard emphasizes the tonic, stimulant, and diuretic properties of caffeine which he considers an excellent cardiac stimulant and a powerful diuretic, when administered in large doses. Injections of caffeine lower the temperature in typhoid fever and counteract the symptoms of general depression. Huchard advises its use in cholera.

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Use.—The following formulæ are quoted after Tanret, who has experimented with a view to produce preparations in which the caffeine will not be deposited.

Caffeine may be administered internally, according to the following formula:

Distilled water, ...	fl. ℥ x.
Benzoate of sodium,	
Caffeine, ...	āā ℈ iv.

From two to five tablespoonfuls per day.

In order to avoid the gastric troubles often following the administration of the drug by the mouth, hypodermic injections are given when the potion is not well borne.

I. Benzoate of sodium, ...	gr. liij.
Caffeine, ...	gr. xxxviij.
Distilled water, ...	♏ lxxxvij.

or a sufficient quantity to make ♏ 160. ♏ xvi. contain gr. iv. of caffeine.

II. Salicylate of sodium, ...	gr. xxix.
Caffeine, ...	gr. xxxviij.
Distilled water, ...	♏ lxxx.

or enough to make ♏ 160. ♏ xvi. contain gr. iv. of caffeine. The solution must be effected by heat.

III. Cinnamate of sodium, . . .	gr. xxx.
Caffeine, ...	gr. xxxviij.
Distilled water, ...	q. s.

to make ♏ 160. ♏ xvi. contain gr. iv. of caffeine.

Dujardin-Beaumetz recommends hypodermic injections according to the following formula:

Benzoate of sodium,	
Caffeine, ...	āā gr. xv.
Distilled water, ...	♏ xlviij.

A hypodermic syringeful contains gr. iv. of the drug.

Doses.—Internally, gr. iij.-xij. Hypodermically, gr. ix. with gr. xv. of benzoate of sodium and ♏ 96 of distilled water.

Cakyle.—Synonym: Bunias maritima.

Description.—A plant belonging to the Order of Cruciferæ, indigenous to the north of France, in the neighborhood of Berck.

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Composition.—Contains a sulphuretted volatile oil.

Therapeutical Properties.—Antiscorbutic, according to the experiments by Cazin at the Children's Hospital of Berck.

Lecompte prepares a syrup, analogous to the antiscorbutic syrup of the French Codex.

Use and Doses.—The syrup in doses of fl. ʒ vi. daily.

Calophyllum Inophyllum L.—Synonym: Ndilo.

Description.—A tree belonging to the Order of Clusiaceæ, indigenous to the islands of the Indian Ocean, to Cochin-China, and to Oceania.

Therapeutical Properties.—Oil of ndilo is used in scabies, rheumatism, and cutaneous eruptions.

The crushed bark is applied locally in orchitis. The resin is emetic and purgative.

Calotropis gigantea R. Br.—Synonyms: Mudar, vegetable mercury.

Description.—A plant belonging to the Order of Asclepiadaceæ, indigenous to India and the Molucca islands.

Therapeutical Properties.—Tonic, alterative, diaphoretic, in large doses emetic.

It is used in syphilis, paralysis, epilepsy, worms, herpes, rheumatism, intermittent fever, hectic fever, snake bite, leprosy, and dysentery. The milky sap, which is acrid, serves as a depilatory in tinea tonsurans; it is also used against toothache due to carious teeth.

Use and Doses.—The powdered root is given as an alterative tonic in doses of gr. iv.-ivss., twice a day, in wafers. The powdered bark, as an emetic, in doses of ʒ ss.-i.

Camphorate of Anilin.—Preparation.—A solution of camphoric acid in three parts of alcohol is saturated with anilin in sufficient quantity to render the liquid neutral. The mixture must be kept from the light. On evaporation, crystals are obtained.

Description.—The crystals are white or of a faint reddish tint, almost odorless, but have an acrid and biting taste; they are very soluble in water, alcohol, ether, and glycerin; but these solutions, excepting the last, decompose under the influence of light and even of the air; the glycerin solution should, therefore, be preferred for medicinal use.

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Therapeutical Properties.—A powerful antiseptic and antispasmodic.

Use and Doses.—Ethereal solution (1:4), in gelatin capsules, gr. ss., gr. viij. in twenty-four hours. Maximum dose, gr. iij., if given once; and gr. xij. in twenty-four hours.

Camphorated Phenols.—Désesquelle has emphasized the property which naphthol possesses in common with phenol, to liquefy when mixed with camphor. This property may easily be utilized in medicine and surgery.

Guided by this observation, Audoucet found that this property extends to other phenols, such as thymol, resorcin, pyrogallol, and salol which is merely a derivative (salicylate of phenol).

The following are the proportions strictly necessary to produce a soft paste with the substances cited above.

Resorcin, ...	gr. xl.
Camphor, ...	gr. ¾.
Thymol, ...	℈ iv.
Camphor, ...	gr. xv.
Pyrogallol, ...	gr. xl.
Camphor, ...	gr. iss.
Salol, ...	℈ iv.
Camphor, ...	gr. viij.

By increasing the quantities of camphor above indicated, syrupy liquids are obtained which mix in all proportions with oils, lard, and vaselin, which are soluble in alcohol and ether, and insoluble in water. The same result has been obtained with menthol.

The result of these experiments seems to be, that the property formerly ascribed to phenol alone and recognized by Désesquelle in naphthol likewise, is common to all the phenols, and that it is probably a distinctive characteristic of this class of substances.

Cannabis indica Lam.—Description.—A plant belonging to the Order of Urticaceæ, indigenous to India and Persia.

Therapeutical Properties.—It is used in India in tetanus, delirium tremens, infantile convulsions, nervous diseases, asthma, and whooping cough. According to Aronson, the alco-

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holic tincture gives good results as a local anæsthetic, especially for the extraction of teeth.

It has been recommended in obstetrics to hasten labor in atony of the uterus.

Use and Doses.—Tannate of cannabine, gr. i.-iv. Extract, gr. ¼ to gr. iss. Tincture, gtt. v.-xxx.

Canutillo.—[Syn.: Ephedra syphilitica.] A plant derived from Mexico and adjacent parts of the United States.

Therapeutical Properties.—Prescribed with good results by Colcord for blennorrhagia and leucorrhœa. Gleeson considers it a specific for blennorrhagia which yields to it in three days.

Use and Doses.—Fluid extract, fl. ʒ iij. per day, during three days.

Caranna.—Caranna resin, from Icica icicariba. A plant belonging to the Order of Terebinthaceæ, indigenous to Central and South America.

Therapeutical Properties.—Reduces glandular swellings. It is used in inflammation of the spleen, as well as for wounds and ulcers.

Carapa guianensis Aubl.—Synonyms: Crab nuts, Carapa touloucouna.

Description.—A plant belonging to the Order of Meliaceæ, indigenous to Guiana and the Senegal.

Composition.—From the seeds a thick oil is extracted, which has the consistence of butter, is unctuous to the touch, yellow in color, and has a bitter taste.

Therapeutical Properties.—The oil is much employed by the natives as an effective remedy against cutaneous affections, and the stings of mosquitoes and flies. The fruits are emetic. The bark is bitter, tonic, and febrifuge.

Carbolate of Camphor.—Synonym: Phenolated camphor.

Preparation.—A 95% solution of phenic acid is saturated with camphor.

Therapeutical Properties.—It possesses the antiseptic properties of phenol, and the sedative and carminative properties of camphor. It has been studied by Soulès, and later by Cochrane. It is less caustic than phenic acid.

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Use and Doses.—Externally, as a caustic for swabbing diphtheritic patches and fungous sores.

Internally, gelatin capsules containing gtt. x. of the drug.

Carbonaphtholic Acid.—Preparation.—It is obtained by making carbonic acid react upon naphthol in the presence of sodium.

Description.—It is almost insoluble in water, soluble in alcohol and ether, slightly soluble in a solution of borax or of phosphate of sodium.

Bacteriological Properties.—Antiseptic; it does not seem to possess any advantage over the agents generally used. A solution 1:20,000 retards the development of putrefactive bacilli; a solution 1:2,000 kills the micro-organisms, and a solution 1:300 arrests advanced decomposition; it is toxic in large doses.

Carbonic Acid.—Therapeutical Properties.—Used for inhalation in whooping cough, in which, according to Petit, it produces excellent results in the apyretic stage. Speedy cure has been secured in a case of whooping cough of over six months' standing, by aspiration of this gas produced artificially; since then, similar results have been numerous, and the best effects have been obtained. The first effects of this treatment are the cessation of the vomiting, modification of the cough the attacks of which occur at longer intervals, become less intense, and are less painful. The appetite is rapidly regained, digestion is good, the general condition improves promptly, and recovery ensues speedily.

Bardet has used it in a gaseous and a solid state, as an analgesic.

Debove obtains revulsive effects of remarkable intensity with snow of carbonic acid. In sciatica it is also applied along the course of the affected nerve.

By inhalation, it stops hiccup which has resisted every other treatment; it is also used in asthma and spasmodic cough.

It is given by rectal injection, associated with sulphuretted hydrogen, for tuberculosis; when used for this purpose, it must be prepared from pure substances and be free from air. If these precautions are neglected, the rectal injections are painful and give rise to colic.

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In gynecology, vaginal injections of the gas are given as an anæsthetic, in uterine cancer.

Finally, the gas is used in minor surgery as an anæsthetic in slight operations, by directing a jet for some minutes on the part in question.

Carica Papaya L.—Synonyms: Papaw, Melon tree.

Description.—A plant belonging to the Order of Bixaceæ, indigenous to the Antilles. A liquid, milky, and neutral sap exudes from incisions. This is mixed with glycerin, sugar water, and essence of mint, to preserve it in transit.

Composition.—Contains papaine, investigated by Wurtz.

Therapeutical Properties.—Papaine is the most powerful solvent of fibrin known. It is a digestive ferment which attacks, softens, and finally, at 102° F., dissolves meat, fibrin, albumen, and gluten. It is used for dissolving diphtheritic patches, corns, warts, and callosities of the skin in general.

It is also used for the removal of furfuraceous blotches from the face.

Papaine is perfectly anodyne when administered internally, even in large doses, in cases of gastric affections; it lessens the acidity of the saliva.

The seeds are vermifuge and tænicide; the fresh roots are rubefacient.

Use and Doses.—Four-per-cent solution, used in diphtheria. Pills of one grain, two or three of which are taken in nephritic fever and colic. Mixture: papaine, gr. xij.; borax, ʒ i.; water, fl. ʒ ij., for painting warts and condylomata.

Carnauba.—Synonym: Corypha cerifera.

Description.—A plant belonging to the Order of Palmaceæ.

Part Employed.—The root.

Therapeutical Properties.—Alterative, diuretic; the same properties as sarsaparilla, but more energetic. Used in secondary syphilis, syphilitic ulcers, eruptions, and rheumatic affections.

Dose.—Decoction (ʒ i. in O i.), fl. ʒ i. per day.

Cascara amarga.—Synonyms: Picramnia antidesma, Honduras bark.

Description.—A plant belonging to the Order of Rutaceæ.

Composition.—The plant contains an alkaloid, picramnine,

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soluble in chloroform, slightly soluble in ether and benzin, insoluble in acids and alkalies. The salts are amorphous and soluble in water only.

Therapeutical Properties.—Dr. Frohling, of Mexico, uses the drug as an alterative for syphilitic tuberculosis (!).

The fluid extract is given in the secondary syphilis of adults. The symptoms disappear quite rapidly, and the tonic action of the medicament is remarkable.

In a case of specific iritis Frohling observed manifest improvement after three days. Atropine had been discontinued.

Use and Doses.—Fluid extract, gtt. 40–50.

Cascara sagrada.—Synonyms: Rhamnus Purshianus D. C., Holy bark.

Description.—A plant belonging to the Order of Rhamnaceæ, indigenous to Califorina.

Composition.—A. B. Prescott, of the University of Michigan, found tannin, oxalic acid, malic acid, starch, a fixed oil, a small proportion of ethereal oil, and four resinous bodies more or less soluble in alcohol, ether, chloroform, bisulphide of carbon, etc.

Limousin believes that these latter bodies are all derivates of chrysophanic acid, the existence of which Prescott does not state, but of which Limousin has discovered a notable quantity.

Therapeutical Properties.—According to Limousin, this bark seems destined to occupy an important place among purgative drugs.

The bark is about the size of the large quills of gray cinchona bark, rather dark on its external surface, and of a reddish-yellow on its internal surface. Both sides are generally smooth, especially the interior, for the outer side is sometimes slightly rugous and covered with whitish lichens. If the superficial layer of the bark is scraped away, the interior is exposed and appears as a pale yellow tissue which presents a certain analogy with the color of rhubarb and, like the latter, darkens in the air, especially in the presence of some ammonia.

It is used in obstinate dyspepsia or bilious constipation, particularly when other cathartics are not well borne; as a tonic and laxative, in intermittent and remittent fevers.

Use and Doses.—Landowsky has demonstrated the laxative effects of the drug in the dose of gr. iv. of the powder

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given in wafers; and its purgative action when this dose is repeated three or four times at several hours' interval.

Fluid extract, gtt. x.–lx. American physicians often give it in this form; but when thus administered the medicine is not well borne by the patients, owing to its nauseous taste. Syrup, prepared from fl. ʒ iss. of the fluid extract in fl. ℥ i.

Cashew.—Synonyms: Anacardium occidentale L., caju, cajuero, antidiabetic bark.

Description.—A plant belonging to the Order of Terebinthaceæ, indigenous to Brazil, Central America, and the Antilles.

Composition.—The pericarp of the nuts contains an oil known as cardol.

Therapeutical Properties.—A maceration of the bark is used in diabetes insipidus; as far as possible the patient must abstain from water.

The nut is employed locally for intractable dermatoses (eczema, psoriasis).

Cazeneuve de la Roche recommends it internally for impotence and particularly for the debility following grave diseases. He has used the tincture largely in cases of influenza, with good results.

Cardol, the oil of the pericarp, is caustic and vesicant. It is recommended as an external application in lepra and deep ulcers. It must be used with care; but it has no vesicant effect on the digestive canal.

Use and Doses.—One ounce of the bark is macerated for twenty-four hours in half a pint of water. Doses: a small wineglassful three or four times a day. If no improvement is noticed at the end of three or four days, ʒ iiss. of the bark is added to the macerate. Tincture of the nut (1:5), dose ♏ xxxv. in a draught. Tincture of cardol (1:10), gtt. ij.–x., as a vermifuge.

Cassia alata L.—Description.—A plant belonging to the Order of Leguminosæ, Tribe Cæsalpinieæ, indigenous to Cochin-China, Mauritius, and South America.

Composition.—Contains chrysarobin.

Part Employed.—The leaves.

Therapeutical Properties.—Daruty recommends it for local application in the treatment of eruptions, principally tinea cir-

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cinata and syphilitic patches. Internally, this plant takes the place of senna and colocynth; it is alterative.

Use.—Cataplasms of the bruised and macerated leaves. Tincture, 1:5. Syrup.

Cassia auriculata.—Synonym: Cassia Absus L.

Therapeutical Properties.—The seeds are employed in Egypt as a popular remedy for inflammatory affections of the eyes (ophthalmia).

Internally, the seeds are considered by Ainslie as refreshing and attenuant.

The seeds are well dried and powdered, mixed with some sugar, and insufflated into the eyes. Graefe has obtained good results with the drug in corneal opacity.

Cassia occidentalis L.—Synonyms: Fedegosa, Negro coffee.

Description.—A leguminosa, indigneous to Cochin-China, India, the Antilles, the Senegal, and to America from Mexico to Patagonia.

Part Employed.—The seeds, which have been introduced by Natton, and further studied by Heckel, Schlagdenhauffen, and Clouet.

Composition.—No other principle has been found than tannin and a coloring matter, the achrosin of Clouet. Formula, $C_{11}H_{18}O_8$.

Therapeutical Properties.—The seeds possess eminent febrifuge and antiperiodic properties, so that they are used in place of quinine when the latter fails. They are also tonic and anti-anæmic. The root is tonic and diuretic. The leaves are febrifuge and antiperiodic. Martineau has recommended the plant as a reconstructive and anti-dysmenorrhoic; it is very useful in fever and the sweats of phthisis.

Use and Doses.—Infusion of the root, ʒ i. in fl. ℥ vi. of water per day. Decoction of the leaves, ʒ i. of the latter in fl. ℥ x. of water, boiled down to fl. ℥ viij., in one dose. Infusion or maceration of the seeds, ʒ ss. in fl. ℥ viij. of water, to be taken in two or three doses. Infusion of the roasted seeds, like an infusion of coffee. Natton recommends a wine, ℥ iij. of cassia in one quart of wine, and an elixir, O i. of tincture of cassia in O i. of simple syrup, in doses of four teaspoonfuls per day.

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Catha edulis.—Description.—A shrub belonging to the Order of Celastraceæ, indigenous to eastern Africa, spread from Abyssinia to Port Natal, cultivated in European greenhouses, flourishing in the neighborhood of Mentone.

Composition —Flückiger, who has analyzed catha leaves, has found no caffeine in them. He has extracted from them a small quantity of a liquid alkaloid (katine) dissolving readily in water, which solution reddens paper impregnated with phenolphthalein.

Preparation.—The acetate of katine can be obtained in crystals; its solution is not precipitated by either tannin or platinum chloride.

Therapeutical Properties.—The leaves, called kât, when chewed produce an agreeable excitement, similar to cocaine. Calmative and anaphrodisiac properties are attributed to them.

Caulophyllum thalictroides Mich.—Description.—A plant belonging to the Order of Berberidaceæ, indigenous to North America.

Part Employed.—The root, or rather the rhizomes.

Composition.—Yields caulophyllin (a precipitated resin).

Therapeutical Properties.—Antispasmodic, tonic, diuretic; besides, stimulant, emmenagogue, sudorific; useful toward the end of pregnancy.

Some American physicians consider the plant superior to ergot of rye when the sluggishness is due to fatigue or debility.

Caulophyllin is tonic.

Use and Doses.—Decoction (℥ i. in fl. ℥ x.), fl. ℥ i.–ij. Fluid extract, ♏ xxv. to fl. ʒ i. Tincture (1:5), fl. ʒ ij.–vi. Alkaloid, gr. ij.–iv.

Cayapona globulosa L.—Description.—A plant belonging to the Order of Cucurbitaceæ, indigenous to Brazil.

Therapeutical Properties.—An energetic purgative, used as an evacuant in chronic cutaneous disorders, also as a powerful emmenagogue.

The fruits are drastic, like colocynth. The alkaloid, cayaponine, is a strong purgative in doses of gr. $\frac{1}{10}$.

Hypodermically it is irritant, without purgative effect (Delpech).

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Chaulmugra or *Chaulmoogra.*—Synonym: Gynocardia odorata.

Description.—A tree of India, belonging to the Order of Bixaceæ

Preparation.—Chaulmoogra oil is extracted from the seeds.

Therapeutical Properties.—The natives use it in skin diseases, scrofula, and syphilis.

In warm climates, in Mauritius, and in Reunion, physicians have employed it almost daily in leprosy, particularly the tubercular and anæsthetic forms. In the phagedenic phases the drug effects a rapid cure.

Marsh has used it in a case of pustular eczema of five years' standing, the oil being freely painted on, twice a day, combined with tonic internal treatment; at the end of five weeks the eruption had disappeared, leaving the skin soft and flexible.

Vidal makes use of it to hasten the absorption of tubercles.

A. Hardy has prescribed it with good results in inveterate cases of psoriasis, and Hilles in true leprosy. Egan has cured six cases of chronic sciatica with a liniment of chaulmoogra applied externally.

Murrel recommends its use in phthisis, when the patients are unable to bear cod-liver oil.

Use and Doses.—Internally, the natives take the oil in doses of gtt. xxx.-xl. for adults, and gtt. iij. mixed with milk for children. It may be given in capsules each containing ℥ iij. of the oil; dose, two to four daily.

Externally, the pure oil is painted on. Liniments consist of the oil mixed with alcohol or chloroform or menthol:

Oil, ...	30 parts.
Alcohol, ...	4 "

Vidal uses the following ointment:

Chaulmoogra oil, ...	2 parts.
Vaselin, ...	5 "
Paraffin, ...	1 part.

Gynocardic acid, derived from the oil of Gynocardia odorata, is administered in pills, as follows:

Gynocardic acid, ...	gr. $\frac{2}{3}$.
Extract of gentian, ...	gr. $1\frac{1}{6}$.
Extract of hop, ...	gr. $1\frac{1}{6}$.

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Two pills per day; the dose may be increased to twelve pills per day.

Chimaphila corymbosa.—Synonyms: Chimaphila umbellata, Pyrola umbellata, wintergreen, or pipsissewa.

Description.—A herb growing on every heath.

Composition.—Samuel Fairbank found in the leaves a peculiar substance which he names chimaphilin. The active principle seems to reside in the resin.

Therapeutical Properties.—Sommerville recommends the plant as a diuretic and astringent, in rheumatism, kidney diseases, dropsy associated with digestive disorders, and general debility.

The diuretic effects are especially marked in the systolic period of cardiac affections. The drug is not toxic and does not accumulate in the system.

Use and Doses.—The decoction (ʒ iiss. in O ij.) is the preparation most in use; the dose is one pint in twenty-four hours. Infusion. Maceration. Tincture. Hydro-alcoholic extract.

Abet gives the following formula for pills:

Hydro-alcoholic extract, ...	ʒ v.
Licorice, ...	q. s.

To make 60 pills; two pills every two hours.

Chinoiodine.—Preparation.—Produced by the addition of chinoline to chloride of iodine. Formula, C_9H_7NICl.

Description.—A crystalline, micaceous powder, of faintly yellow color, insoluble in water, slightly soluble in alcohol and ether.

Therapeutical Properties.—An odorless antiseptic which may take the place of iodoform.

Chinoline.—Formula, C_9H_7N.

Preparation.—Obtained by the dry distillation of quinine or of cinchonine. May also be prepared by the oxidation of nitrobenzin and of anilin.

Description.—An oily, transparent, slightly colored, mobile, refracting liquid, of a peculiar odor, soluble in alcohol, insoluble in water.

Salts.—Forms crystalline salts, the tartrate and the salicylate, which are soluble in water in the proportion of 1:40.

Therapeutical Properties.—Antipyretic, used in intermit-

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tent fevers, typhoid fever, and periodical neuralgias. External use, general or local antiseptic, sterilizing the microbes. A 1% solution dissolves the clots of coagulated blood.

Use and Doses.—Solution for diphtheria:

Chinoline, ...	℈iv.
Alcohol, ...	fl. ℥ iiiss.

Applied with a brush.

The tartrate is prescribed in powder; dose, gr. iv.–viij.

The salicylate, mixed with one-sixteenth of the basic acid, is employed for insufflations in otitis media and externa.

Chionanthus virginica.—Synonym: Fringe-tree.

Description.—A shrub belonging to the Order of Oleaceæ, indigenous to North America; cultivated in European gardens for the beautiful white color of its flowers.

Part Employed.—The bark of the root.

Composition.—Saponin has been found in it by Justice.

Therapeutical Properties.—Aperient, cholagogue, and alterative. Some authors have recommended it for jaundice. J. A. Henning, in fact, regards it as one of the best remedies in this disease and prescribes it in every case in which the skin assumes a yellowish tinge. Though it is only a feeble stimulant for the liver, he recommends it whenever there is congestion of the portal system. At the same time it seems to stimulate the lymphatic system and possesses diuretic and diaphoretic action. When the liver is sluggish, other stimulants must be conjoined—*e.g.*, podophyllin and leptandrin.

Use and Doses.—

Fluid extract of chionanthus, . . .	fl. ℥ i.
Podophyllin, ...	ʒ i.
Acetate of potassium, ...	ʒ ss.
Water, ...	fl. ℥ iv.

One teaspoonful every three or four hours.

The fluid extract is generally given in doses of ʒ ss.–i., two or three times a day.

Chloralamide.—Synonym: Chloral formamide. Formula,

$$CCl_3CH\begin{cases}OH\\NHCHO\end{cases}$$

Description.—Anhydrous chloral combines directly with

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amides to form compounds; for instance, acetamide, formamide. Chloralamide is produced by the addition of anhydrous chloral to formamide. It is soluble in nine parts of water and one and a half parts of alcohol, soluble in hot water; it should not be dissolved in a liquid above 140° F. which would decompose it. Some drops of dilute hydrochloric acid facilitate the solution.

A white, crystalline, brilliant substance of a bitter taste. Fuses at 240° F.

Physiological Properties.—Peiper, Kny, and Bilhaut have ascertained that it has no effect on the circulation of the blood. It has no noxious effect on the heart or the kidneys. It neither lowers nor raises the temperature, nor does it change the rhythm of the respiration.

Therapeutical Properties.—Schultze, Hugen, Lattow, and Bilhaut have successfully used it as an hypnotic, even in cardiac affections complicated with albuminuria.

Chloralamide is very useful in all cases of insomnia, in phthisis, neurasthenia, and diseases of the heart. It eases pain and overcomes slight dizziness. It acts at the end of half an hour and gives a quiet sleep lasting from nine to eleven hours. If administered by hypodermic injection, sleep sets in in twenty-five minutes and continues from seven to nine hours.

Use and Doses.—It is administered in bulk, in wafers, in solution in wine or beer. Limousin prepares lozenges containing gr. iv. The dose for an adult is gr. xlv. per day; for children, gr. viij.; according to Rapon, from gr. xv. to ʒi. Hypodermic injections, gr. $\frac{5}{6}$ to $\frac{1}{2}$ each. Chloralamide may be given by enema, without danger.

Chloral-Hydrocyanate.—Preparation.—The drug is made by mixing hydrate of chloral and hydrocyanic acid in solution.

$CCl_3—CH\begin{matrix}OH\\CN\end{matrix}$

Description.—Crystalline prisms and rhombic plates. Soluble in water, alcohol, and ether. In presence of boiling water and alkalies it decomposes into its two elements. The aqueous solution is stable.

Composition.—6.45 parts of chloral-hydrocyanate represent one part of anhydrous hydrocyanic acid.

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Physiological Properties.—The drug possesses the physiological properties of hydrocyanic acid.

Therapeutical Properties.—Sedative and quieting, proposed by Hermes in place of cherry-laurel water and of preparations of hydrocyanic acid which are unstable and uncertain in effect.

Use and Doses.—Titrated aqueous solution, in suitable doses. [A solution, equivalent to the Acidum Hydrocyanicum Dilutum of the U. S. Pharm. (containing 2% of the anhydrous acid), is obtained by dissolving 13.9 gm. of chloral hydrocyanate in enough water to make 100 c.c.—*Transl.*]

Chloralimide.—A substance first prepared by Choay and Béhal. Formula, CCl_3—CH—NH.

Description.—A colorless, odorless, and tasteless body. It has neither the acrid taste of chloral ammonia nor the bitterness of chloralamide. It crystallizes in long needles; fuses at 334.4° F. Insoluble in water, very soluble in strong alcohol, and still more so in ether; it dissolves likewise in chloroform and fatty substances.

It is not affected by the air, light, or humidity; it is, in fact, remarkably stable. Even when heated in a sealed tube in presence of water, it remains unchanged at 302° F.; the temperature must be raised to 356° F. to decompose it into chloroform and formamide.

The decomposition into chloral and ammonia may be effected thus: platinum chloride is made to react in the cold on chloralimide and furnishes chloral and chloroplatinate of ammonium. If kept in a liquid acidulated with a mineral acid, it likewise gives rise to chloral and an ammonium salt corresponding to the acid employed.

Therapeutical Properties.—Its activity surpasses that of chloral ammonia and of chloralamide.

Use.—In bulk. Wafers. Gelatin capsules. Pastils. Pills. Elixirs. Ethereal, alcoholic, chloroformic, and oily solutions.

Chloride of Methyl.—Synonym: Methylchlorhydric ether, chloromethane. CH_3Cl.

Preparation.—One part of methylic alcohol is mixed with 3 parts of sulphuric acid and 2 parts of sea salt and gently heated. To prepare it on a large scale, the hydrochlorate of methylamine derived from various industries is heated in the presence of watery vapor.

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Description.—It is gaseous at the ordinary temperature and liquefies at the pressure of six atmospheres. When in a liquid state and allowed to evaporate, it gives rise to a considerable degree of cold which is used industrially.

Therapeutical Properties.—Anæsthetic; its action is somewhat similar to that of chloroform, though it is less energetic.

Use.—Employed by inhalation like chloroform. Used particularly in a liquid state for local spray.

Debove has recommended it in the treatment of sciatica, by being sprayed along the course of the nerve for five seconds; one application to be made every other day. The same treatment is given in obstinate neuralgia.

Bardet limits the action by painting the spot to be treated with glycerin.

In minor surgery, the part to be operated upon is sprayed with a jet of chloride of methyl.

It is preferable, however, to use the method of Bailly, which consists in soaking a cotton tampon with chloride of methyl and painting the spot until it is anæsthetized. This operation is called *stypage;* and the tampon, *stype.*

Chrysarobin.—Synonym: Ararobin. $C_{30}H_{26}O_7$.

Preparation.—Derived from goa powder, which contains 80%, by the aid of benzin, chloroform, or bisulphide of carbon.

Therapeutical Properties.—Recommended for skin diseases.

Use and Doses.—It is employed in the form of an ointment, contact with the eyes being guarded against. Internally, it is exhibited in doses of gr. $\frac{1}{6}$ to gr. iss., in pills (Limousin).

Chrysophanic Acid.—Synonyms: Rheic acid, rhein.

Preparation.—Extracted from rhubarb, certain species of Rumex, etc.

Therapeutical Properties.—It is used internally as a purgative, but causes inflammation of the mucosæ and often of the kidneys. Externally, it is employed in skin diseases, particularly psoriasis, by local applications.

Since this drug manifests its curative action not only at the points of application; but, being absorbed, affects also regions which have not come in contact with the drug, Stocquart conceived the idea of administering it internally and hypodermically. The dose injected under the skin never exceeded $\frac{1}{100}$ to $\frac{1}{6}$ of a grain; two was the highest number of

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injections given; yet recovery was rapid. The hypodermic injections, however, often caused abscesses, hence the drug should be used in this way only in the most rebellious cases, and with extreme caution.

Doses.—Externally, gr. xxx. in ʒ i. of lard. Internally, from gr. ¼ for children to gr. ss. for adults, in pill form.

Cimicifuga racemosa Ell.—Description.—A plant belonging to the Order of Ranunculaceæ, Tribe Actææ.

Part Employed.—The rhizome.

Composition.—It contains a resin and an alkaloid, cimicifugine. In America the name cimicifugin is often applied to the precipitate of the tincture by water.

Therapeutical Properties.—Alterative, diaphoretic, and nervine in rheumatism, spasms, headache, and hypochondria. It is employed as a substitute for digitalis. It is a prophylactic. According to Knox, it shortens the first and second stage of labor at least one-half. It has a sedative effect on women in labor, calms the reflex irritability, nausea, pruritus, and insomnia which are so frequent during the last six weeks of pregnancy, and may banish them altogether. It acts antispasmodically in women during the puerperium. It diminishes or arrests the neuralgic cramps and the irregular pains of the first stage. It relaxes the muscular fibres of the uterus and soft parts of the parturient canal. Hence it facilitates labor and lessens the chances of laceration. It increases the energy and rhythm of the pains in the second stage of labor and, like ergot, insures uterine contraction after delivery.

Use and Doses.—Tincture (1 : 4), gtt. xv.–ʒ i. Fluid extract, gtt. x.-xxx. Syrup, ♏ xv. of the fluid extract in syrup of sarsaparilla, during four weeks before labor. Cimicifugin, gr. ¼ to gr. iij., in pills.

Cinchonamine.—An alkaloid extracted from the bark of Remijia purdieana Wedd., of the Order of Rubiaceæ. Formula, $C_{10}H_{24}N_2O$. Discovered by Arnaud, under the directions of Dr. Triana.

Physiological Properties.—In animals it paralyzes the heart in diastole. It augments the salivary secretion, by reason of a direct action upon the gland, independent of its influence upon the central nervous system. Introduced into the stomach of a dog weighing nine pounds, in the minimum dose of gr. iiss.,

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it produces convulsive phenomena, preceded by lowering of the blood-pressure, and accompanied by cerebral effects resembling hallucinations.

Therapeutical Properties.—The sulphate of cinchonamine produces a gradual diminution of the forces of the nervous centres; it lessens the number and strength of the heart beats. It is a substitute for quinine, but is four times more active.

Cineraria maritima.—Synonym: Senecio maritima.

Description.—A plant belonging to the Order of Compositæ-Synanthereæ Senecioneæ, common on the sea coasts, particularly in the south of Europe. It has long been cultivated in gardens for its silvery-white foliage which depends upon the fine, silky, and dense down with which nearly all the parts are covered. It is commonly found on terraces, forming either borders or beds. Its deeply indented leaves, its yellow flowers, and its general appearance are easily recognized. The plant should not be confounded with Artemisia maritima which greatly resembles it and grows in the same localities (A. Mussat).

Therapeutical Properites.—The sap of the plant, indicated in the treatment of cataract, is a valuable remedy in ophthalmology. Mercer has cured a case of blindness by the use of two drops of the sap placed upon the conjunctiva three times a day.

Cocaine.—Description.—An alkaloid discovered by Niemann in the leaves of Erythroxylon Coca Lamk., Order Erythroxylaceæ ($C_{17}H_{24}NO_4$, Lossen). Coca leaves contain from 0.02 to 0.2% of cocaine. From the same leaves Lossen has isolated a second, volatile, feeble, and somewhat doubtful alkaloid, hygrine. The other known principles of coca leaves are ecgonine, coca-tannic acid, and a peculiar wax.

Cocaine crystallizes on the monoclinic system; it melts at 208.4° F.; it dissolves in alcohol, better in ether, but requires 704 parts of water for solution; it dissolves also in 20 parts of melted vaselin or castor oil. Heated with concentrated hydrochloric acid, it decomposes into ecgonine, benzoic acid, and methylic alcohol.

The commercial salts of cocaine are: the hydrochlorate, the salicylate, the hydrobromate, the tartrate, and the citrate.

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Physiological Properties.—It has been studied in France by Bordereau, Coupard, and Laborde, who have confirmed the phenomena previously described by German investigators.

A Guinea-pig weighing about 7¾ oz. received subcutaneously gr. ss. of hydrochlorate of cocaine. Ten minutes after the injection, general convulsions, chiefly clonic, ensued, together with recurring attacks of opisthotonos. Then followed successively complete loss of the ocular reflex; insensibility to needle pricks and pinching, then a slight tickling, or simply breathing on the animal, elicited reflex movements; very marked dilatation of the pupils, motor paresis of the posterior limbs following convulsive attacks which were easily excited by peripheral irritation. Despite the return of the ocular reflex after the lapse of about an hour, the cessation of the mydriasis, and the return to the normal state, the animal succumbed during the night, with notable persistence of the general insensibility.

Therapeutical Properties.—Koller has demonstrated that cocaine is a notable local anæsthetic for the eye. Trousseau and Abadie state that the cornea is rendered insensible in two or three minutes, so that foreign bodies can be removed from the cornea or tattooing performed. After several instillations, insensibility is complete so that all operations can be performed (for cataract or strabismus). The drug is very serviceable in sclerosis of the cornea, iritis, and irido-choroiditis. Panas states that the action of cocaine fails when the eye is inflamed.

Lafosse averts the dyspnœa during the washing out of the stomach by painting the pharynx with a 2% solution.

Campardon has arrested very obstinate hiccough in typhoid fever by its use.

Dujardin-Beaumetz has dispelled violent gastro-intestinal pains by means of cocaine. Fovel and Gouguenheim have recommended it for anæsthetizing the pharynx and the vocal cords. In laryngitis, acute pharyngitis, and ulceration of the epiglottis the pain ceases promptly under the use of cocaine.

Kohler has arrested uncontrollable vomiting in hysteria by painting the pharynx with a 10% solution of the drug.

In the case of burns, Weiss advises it to be painted over the wound to quiet the pain.

In gynecology, Doléris and Dubois have employed it to

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lessen the pains of labor, by painting a solution on the cervix uteri, the vaginal walls, and the vulva.

Huchard has exhibited it with success in facial erysipelas and pruritus ani.

In a case of vaginismus, Cazin has cured the spasm of the vulva by the injection of a 2% solution.

Unna has recommended the drug for the cure of fissure of the nipple without interrupting the nursing.

Labric has found a new therapeutic use for cocaine in infantile whooping cough. In coryza of the newborn, Semtescho has found it useful in the nasal fossæ. The coryza of adults also ceases after the use of a 2% solution.

Paul Bert stops the pain caused by vesicants by injecting into the bullæ some drops of a cocaine solution.

In odontology, according to David, it soothes the pain associated with affections of the gums, with periostitis, with diseases of the buccal mucosæ, and even those of epithelioma of the tongue.

Finally, in minor surgery, it furnishes an anæsthetic which suffices for the performance of painless operations, especially in fistula ani in which chloroform is contra-indicated.

Use and Doses.—Direct application to the moist mucosæ, by means of a small brush. For this purpose the solution varies in strength, according to the nature of the case, from 2 to 20%. For subcutaneous injection, gr. $\frac{1}{4}$ to $\frac{1}{3}$ in ℥ xvi. of water.

Inconveniences of the Abuse.—The abuse of the drug causes grave accidents, similar to those following the abuse of morphine. If cocaine is employed in injections exceeding gr. iij. of the drug, syncope or cerebral anæmia may ensue.

Cocaine Hydrochlorate.—Description.—This is the salt chiefly used. It looks like a white amorphous powder, but in reality is composed of fine white needles. As a rule, it has a peculiar odor [?—when pure, it is odorless.—*Trans.*], which is more marked in the alkaloid and may be due to the liquid from which it has crystallized.

It is soluble in three parts of water and in all proportions in alcohol.

Therapeutical Properties.—Antiseptic; its action on the tongue and mucous surfaces is more intense than that of the alkaloid.

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Use and Doses.—Externally, 5% to 10% solutions. For collyria, gr. ivss. in fl. ʒ iij. Internally, gr. ¼ to gr. ½.

Cocaine Citrate.—Description.—Small white, deliquescent crystals.

Therapeutical Properties.—Recommended for use in dentistry.

Use.—Pills which, wrapped in cotton and moistened, are inserted in the cavity of carious teeth and cause anæsthesia of the pulp.

Cocaine Saccharinate.—Description.—A combination of saccharin and cocaine; described by Hays who states that it is soluble in water and pleasant to the taste.

Use.—For application to the pharynx in young children.

Cocaine Salicylate.—Therapeutical Properties.—Recommended in ophthalmology, owing to the stability of the solutions.

Cocillana.—Description.—A plant belonging to the Order of Meliaceæ, indigenous to Bolivia.

Part Employed.—The root.

Therapeutical Properties.—It is used with success in acute or chronic bronchitis. It facilitates expectoration and liquefies the sputa. The powder is not employed because it causes sneezing, coryza, and dryness of the throat.

Use and Doses.—Tincture of the root (1:6), ʒ iiss. per day, in doses of ʒ ss. every two hours.

Coix Lacryma.—Synonym: Job's tears.

Description.—A plant belonging to the Order of Gramineæ-Phalarideæ, indigenous to China, Cochin-China, and the island of Reunion.

Therapeutical Properties.—The seeds are analeptic, largely used in China and Japan. The alcohol extracted from the seeds is employed in rheumatic affections. The decoction and the tincture are emollient in catarrhal affections, bronchitis, and inflammations of the urinary passages; their effect is diuretic, purifying, and refreshing.

Colchicine.—An alkaloid extracted from colchicum seeds, from Colchicum autumnale, a plant belonging to the Order of Liliaceæ, indigenous to Europe.

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Description.—A yellowish-white powder, of a persistent bitter taste, soluble in water, alcohol, and chloroform; melts at 305.6° F. Formula, $C_{17}H_{23}NO_6$. It has been studied by Pelletier, Hesse, and Houdé.

Reaction.—With nitric acid, a yellow color which passes through green, red, violet, and finally disappears. With an alkali, a persistent red color. With concentrated sulphuric acid and the addition of a crystal of saltpetre, a blue, green, and finally violet color. With sulphovanadate of potassium a violet color.

Physiological Properties.—Laborde has studied its physiological action. The effect produced manifests itself slowly. It excites the motor nerves, makes the contractions of the heart more numerous and irregular, and finally retards them. On the gastro-intestinal tract the effects are: nausea, vomiting, and diarrhœa. It has a tendency to arrest the respiratory movements and to produce symptoms of asphyxia.

Therapeutical Properties.—A specific for gout; according to Laborde and Houdé it cures the attacks of gout, and prevents their recurrence. It is also used in nervous affections. In larger doses colchicine is diuretic and purgative.

Use.—Granules. Wine. Hypodermic solution.

Dose.—Gr. $\frac{1}{120}$.

Collinsonia canadensis L.—Description.—A plant belonging to the Order of Labiatæ, indigenous to North America.

Therapeutical Properties.—Astringent and tonic, antispasmodic and diuretic; largely used in cystitis, dysmenorrhœa, prostatitis, gonorrhœa, dropsy, and calculous affections of the bladder. It is employed as a tonic in the convalescence from grave fevers.

Use and Doses.—Fluid extract, fl. ʒ iss.–iij.

Colubrina reclinata.—Description.—A plant belonging to the Order of Rhamnaceæ, indigenous to South America.

Part Employed.—The bark.

Composition.—Contains a bitter principle.

Therapeutical Properties.—It is used in the preparation of a tonic and laxative stomachic drink.

Use.—A tea, which is tonic, is made with the leaves.

Doses.—Fluid extract, gtt. x.–xx.

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Comocladia integrifolia L.—Synonyms: Bresillette, false bresillette.

Description.—A tree belonging to the Order of Terebinthaceæ, indigenous to the Antilles and tropical America.

Therapeutical Properties.—The sap of the bark, which is viscous and very acrid, destroys warts and has a favorable effect on herpetic eruptions. The bark possesses hypnotic properties.

Condurango.—Synonyms: Gonolobus Condurango Triana, Condur Angu (liana of the condor).

Description.—A plant belonging to the Order of Asclepiadaceæ, indigenous to the equatorial regions.

Composition.—Contains tannin, a resin, and three glucosides, condurangins (Vulpian, Kobert, Tanret, Bocquillon).

Part Employed.—The bark, which alone is active.

Therapeutical Properties.—Bitter, aromatic, tonic, successfully employed in the treatment of diseases of the stomach.

Having been recommended as a specific in cancer and having failed to give the expected results, it has fallen into desuetude.

Buisson, of Paris, and Hoffmann, of Basle, have again taken up the therapeutical study of this drug. Buisson recommends its tonic, antiseptic, and hemostatic properties in indolent ulcers which close rapidly under its effect.

Though it does not cure cancer, it at least procures great relief to the patient, by restoring the appetite and rapidly arresting the hemorrhages. In two or three days it arrests the attacks of hæmatemesis in round ulcer of the stomach and gives good results in the anorexia of phthisis.

Use and Doses.—Decoction, ʒ ss. in fl. ʒ vi. of water. Fluid extract. Powdered bark, as a local application to ulcers. Internally, gr. xv. to ʒ i. Wine, three tablespoonfuls per day. Tincture (1:5), two tablespoonfuls per day.

Contrayerva.—Synonym: Dorstenia brasiliensis Lamk.

Description.—A plant belonging to the Order of Moraceæ, indigenous to Brazil.

Part Employed.—The root.

Therapeutical Properties.—It stimulates the digestive organs in atony; moreover, it is diaphoretic and stimulant. A prophylactic.

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Use and Doses.—Infusion, ʒ i. of the root in O i. of water. Powdered root, ʒ ss. per day; ʒ i.–ij. as a diaphoretic.

Convallaria majalis.—Synonym: Lily of the valley.

Description.—A plant belonging to the Order of Liliaceæ-Asparagineæ, indigenous to Europe.

Parts Employed.—The leaves and roots.

Composition.—Contains two glucosides isolated by Gallois, convallarin, soluble in alcohol, insoluble in water; and convallamarin, soluble in water and alcohol, insoluble in ether. This glucoside is decomposed by acids into convallamaretin and glucose.

Therapeutical Properties.—A cardiac remedy, neither as tonic nor as cumulative as digitalis. According to C. Paul, it is the only heart tonic. Used in dyspnœa, palpitation, affections of the heart, hypertrophy, pericarditis, and anæmia. It is diuretic.

Use.—Aqueous extract, alcoholate, potion, syrup, tincture.

Doses.—Extract of the flowers, ♏ xvi.–xxxij. Alcoholate, ♏ xvi. to fl. ʒ iij. Tincture, gtt. v.–xx. Syrup (fl. ʒ iij. in fl. ℥ xij. of simple syrup), two to three teaspoonfuls per day. Convallamarin, in wafers or pills, gr. ¼–iss. per day.

Coptis anemonæfolia.—Description.—A plant belonging to the Order of Ranunculaceæ, indigenous to Japan.

Composition.—Contains berberine, in the proportion of 8 to 10%.

Therapeutical Properties.—Bitter tonic, used in debility, convalescence, atonic dyspepsia, diseases of the mucosæ, and slight intermittent fevers. The infusion is recommended for aphthæ and stomatitis in children.

Use and Doses.—Infusion (ʒ v. in O i. of water), in doses of fl. ℥ ij., three times a day. Powdered root, gr. viij.–xxiv. Tincture (1:5), fl. ʒ ss.–ij.

Cornus florida L.—Synonyms: Cornel, dogwood.

Description.—A tree belonging to the Order of Cornaceæ, common in the marshes of North America.

Composition.—Contains cornine (Geiger).

Therapeutical Properties.—The bark of the root is tonic, astringent, and febrifuge; it is used in the treatment of the

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diseases of women. Its properties resemble those of quinine.

Use and Doses.—Powder, gr. xxiv. to ʒ i. Fluid extract, ♏ xvi.–xlviij. Cornine, gr. ¾–iij.

Corydalis formosa Pursh.—Description.—A plant belonging to the Order of Fumariaceæ, common throughout southern Europe.

Composition.—Contains a bitter principle, corydaline.

Therapeutical Properties.—The root is tonic, diuretic, and alterative; given in cutaneous, scrofulous, and syphilitic affections.

Use and Doses.—Fluid extract, ♏ xxx. to fl. ʒ ij. Tincture (1:5), fl. ʒ i.–iv. Corydaline, gr. ¾–iij.

Coto.—Synonyms: Coto verum, probably from Palicurea densiflora [?]. A plant belonging to the Order of Rubiaceæ, indigenous to Bolivia.

Flat pieces, eight to twelve inches in length and ⅜ to ⅝ inch in width, of a reddish-brown color, an aromatic and camphor-like odor, and bitter taste.

Composition.—Contains cotoin, paracotoin, and a volatile alkaloid.

Therapeutical Properties.—The bark is employed in rheumatism, gout, the night-sweats of phthisis, and particularly in obstinate diarrhœa.

Paracotoin possesses the same properties, but acts less energetically.

Use and Doses.—Powdered root, gr. iv. Tincture (1:10), gtt. x.–lx. Cotoin, gr. ivss.–vi., in fl. ʒ iv. of vehicle containing gr. xv. of bicarbonate of sodium and fl. ʒ ss. of glycerin. Paracotoin, gr. iss.–ivss.

Creolin.—Description.—A complex body [proprietary, *Translator*], obtained from coal-tar creosote. Soluble in alcohol and ether; water emulsifies 3%.

Composition.—Naphthalin, 18%; cresylol, 20%; xylenol, 5%; phlorol, 5%; leucolin, 5%; anthracene, 3%; pyridine bases, 2%; indifferent hydrocarbons, and non-volatile matters, among them soda, 42% (Fischer).

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Th. Weyl gives the following proportions:

	German creolin, per cent.	English creolin, per cent.
Hydrocarbons, ...	84.9	56.9
Phenols, ...	3.4	22.6
Acids, ...	1.5	0.4
Sodium, ...	0.8	2.4

Description.—German creolin is neutral to litmus, although the English creolin is alkaline. If the former is vigorously agitated with water, an emulsion is obtained which does not persist as long as that obtained with the latter under the same conditions. Henle therefore concludes that the emulsifying agent in German creolin is not soap, but a gummous material.

Bacteriological Properties.—Kortüm, Jessner, Klamann, and Hugo Marcus have experimented with it in numerous surgical and gynecological operations in which the presence of an antiseptic was necessary. Esmarch has studied it from an antiseptic point of view and accords to it a considerable parasiticide and microbicide effect. A 10% solution suffices to kill the most resistant pathogenic microbes: the Bacillus pyogenes and the Streptococcus aureus are killed in the space of five minutes. According to Hugo Marcus, even much weaker solutions suffice to change any medium into a refractory one. It possesses considerable power; a very dilute solution instantly destroys the bad odor of putrefying liquids.

Eisenberg, of Vienna, recommends a 1% solution for the irrigation of the bladder and the uterus. According to A. Weber, its use appears to be indicated whenever septic manifestations are to be prevented or attacked from the uterus. It may with advantage replace carbolic acid.

Physiological Properties.—The complete innocuousness of creolin has been acknowledged. Administered to dogs in the proportion of gr. iv. to each pound of the animals' weight, no untoward results were observed. Tait in his experiments has pushed the dose as far as gr. xxx. per day and could detect no functional disturbances, while he noted absolute odorlessness of the excreta.

Therapeutical Properties.—Creolin, while possessing antiseptic properties, is neither toxic nor caustic; its carbolic odor is not persistent, and it forms an emulsion with water.

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Applied to wounds in compresses, it dries the purulent secretions, renders them inodorous, and hastens cicatrization in an astonishing degree.

It is used pure in the dressing of gangrenous wounds, ulcerating cancers, in abscess cavities, in fetid discharges from the nose and ear, in leucorrhœa, vaginitis, chronic parenchymatous metritis, etc.

Lastly—an advantage not to be despised by the practitioner—it never injures surgical instruments.

Use and Doses.—The emulsion, containing from one to five spoonfuls of creolin to the quart of water, is most generally employed. As an injection, to the foci of suppuration. As a gargle, spray, or inhalation, in affections of the larynx and bronchi.

Cresalol.—Synonyms: Salicylate of cresol, paracresalol, paracresyl-salicylic ether. A superior homologue of salol, recommended by Nencki.

Preparation.—Heat salicylate of sodium and cresylate of sodium in molecular weights with perchloride of phosphorus. The reaction effects the formation of cresalol and of secondary products, notably chloride of sodium and phosphoric anhydride. The product of the operation is treated with water which takes up the chloride of sodium and the phosphoric anhydride and permits the isolation of the cresalol which is purified by repeated crystallization from alcohol.

Description.—A crystalline substance, insoluble in water, difficultly soluble in alcohol. It is tasteless, and its odor recalls that of salol. It melts at 96.8° F.

Physiological Properties.—Cresalol is decomposed in the system into its components, cresylol and salicylic acid. Nencki administered to a dog weighing 35 pounds, a half-ounce of cresalol during twenty-four hours in doses of ʒ i., without observing any untoward symptoms.

Therapeutical Properties.—It possesses antiseptic properties very similar to those of salol. It is preferable to the latter in certain cases, for instance, when it is desired to effect intestinal antisepsis by means of a relatively innocuous substance.

Use and Doses.—Wafers containing gr. iv. of cresalol, one to eight per day.

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Crescentia Cujete L.—Synonym: Calabash tree.

Description.—A plant belonging to the Order of Bignoniaceæ, indigenous to the Antilles, Brazil, and Venezuela.

Therapeutical Properties.—The bark is employed in mucous diarrhœa. The pulp of the fruit, which is tart, is laxative and expectorant.

Use and Doses.—Alcoholic extract, ℥ ij.–xij. (purgative dose). Decoction, ℥ i. in O ij., boiled down one-half, one teacupful two or three times a day.

Cresol.—Synonyms: Cresylic phenol, hydrate of cresyl, cresylic acid, cresylol. Formula, $C_{14}H_8O_2$.

Preparation.—A higher homologue of phenol. It is obtained in the distillation of coal-tar, the portion coming over between 392 and 410° F. being collected. Wurtz has prepared it by the action of potassa on sulphotoluic acid. The sulphotoluate of potassium is decomposed by hydrochloric acid, and the cresylic acid formed is dissolved out with ether. Friedel prepares it by treating a mixture of chloride of aluminum and toluol with oxygen.

Description.—A colorless, caustic liquid with a creosote odor, insoluble in water, soluble in alcohol, ammonia, and glycerin, very soluble in ether. Boiling point, 397.4° F.

Therapeutical Properties.—The same as those of phenol, to which it is to be preferred on account of its toxicity being only one-fourth that of phenol, and its superiority as an antiseptic.

It is often employed in combination with soda, cresylate of sodium, which possesses antiseptic properties.

Cresotinate of Sodium.—Therapeutical Properties.—Is used as an antipyretic, like quinine and salicylic acid.

Dose.—From ʒ iv. to ʒ ij. per day.

Cresotinic Acid.—Synonym: Cresotic acid. Formula, $C_{16}H_8O_6$.

Preparation.—A higher homologue of salicylic acid, obtained by passing a current of carbonic acid over cresylol and sodium. A compound of cresylcarbonate results, cresotate of sodium, which is treated with hydrochloric acid, when a precipitate of cresotinic acid forms which is collected and purified.

Description.—A white crystalline body, very slightly solu-

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ble in water, freely soluble in alcohol and ether. It melts at 59° F.

Therapeutical Properties.—Those of salicylic acid [but with toxic properties, as has recently been shown. Is commonly present, as a contaminant, in commercial salicylic acid.—*Translator*].

Cryptocarya australis End.—Description.—A plant belonging to the Order of Lauraceæ, indigenous to Australia.

Composition.—Contains cryptocariine, an alkaloid which is fatal to warm-blooded animals, whose respiration is retarded to final asphyxia.

Curare.—Probably partly derived from: Strychnos toxifera (Triplinervia castelneana), which is a tree belonging to the Order of Loganiaceæ, indigenous to South America.

Preparation.—Curare is an extract prepared by the natives. The active principle is curarine, $C_{10}H_{15}N$, an alkaloid without oxygen, whose action is twenty times stronger than that of curare.

Therapeutical Properties.—Used in the treatment of tetanus, epilepsy, chorea, and hydrophobia.

Dose.—Gr. $\frac{1}{4}$ in ♏ xvi., by hypodermic injection.

Cyanide of Mercury.—Preparation.—Red oxide of mercury and Prussian blue are boiled in water, filtered, evaporated, and allowed to crystallize.

Therapeutical Properties.—Antisyphilitic and antiseptic. Has been used successfully in Sweden, by Stellder, in diphtheria.

Use and Doses.—Collutorium:

Cyanide of mercury,	gr. $\frac{1}{8}$.
Tincture of aconite,	♏ xxxij.
Honey,	fl. ʒ vi.

A teaspoonful every half-hour.

Gargle:

Cyanide of mercury,	gr. xv.
Mint water,	O ij.

Cyanide of Zinc.—Preparation.—1. By mixing a solution of acetate of zinc with hydrocyanic acid.

2. By precipitating hydrocyanate of ammonium by a solution of pure sulphate of zinc.

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Description.—A white powder, insoluble in water and alcohol.

Therapeutical Properties.—Laskevich recommends it as an active remedy in certain affections of the heart, superior to all others, especially in cardiac neuroses. It promptly moderates and sometimes cures palpitation, arhythmia, and pain in the cardiac region.

Use and Doses.—Pills or granules, in doses of gr. $\frac{1}{12}$, three times a day.

Cynara Scolymus L.—Synonym: Artichoke.

Description.—A plant belonging to the Order of Compositæ-Synantherеæ.

Physiological Properties.—The decoction of the flowers curdles milk.

Therapeutical Properties.—Bitter, tonic, antirheumatic, and diuretic.

Use and Doses.—The tincture of the leaves is diuretic, in doses of three wineglassfuls per day. The decoction of the root is also used as a tonic.

Cypripedium pubescens. — Synonyms: Venus' slipper, ladies' slipper.

Description.—A plant belonging to the Order of Orchidaceæ, indigenous to North America.

Part Employed.—The rhizome.

Preparation.—Cypripedin (a "resinoid") is prepared by precipitating the alcoholic tincture with water.

Therapeutical Properties.—Tonic, stimulant, antispasmodic, and diaphoretic.

Cypripedin is narcotic, in addition to the other properties of the root. It may be prescribed for children, in place of opium. It is used in nervous diseases and epilepsy.

Use and Doses.—Fluid extract from the root, ♏ iij.-iv. Powdered rhizome, gr. xv.

Damiana. — Synonyms: Turnera aphrodisiaca, Turnera ulmifolia, Turnera opifera.

Description.—A plant belonging to the Order of Turneraceæ, indigenous to Brazil, Jamaica, Mexico, and California.

Therapeutical Properties.—Used as an aphrodisiac and diuretic; in Jamaica, it is rated as a tonic and an expectorant, and in Brazil. as an astringent.

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The infusion is employed as a demulcent in dyspepsia, indigestion, paralyses, affections of the spinal cord, diseases of the kidneys and bladder, nephritic albuminuria, and diabetes.

It is a nervous tonic in amaurosis, and a tonic of the genito-urinary system.

Stimulant, anticatarrhal, indicated in slow convalescences.

Use and Doses.—As a tonic, in decoction, in the proportion of one ounce to the quart. In infusion (℥ iiss. : O ij.), fl. ʒ ij.–iv. at a dose. Tincture (1 : 5), fl. ʒ i.–iij. Fluid extract, ♏ xxx. to fl. ʒ ij., three times a day. Soft extract, gr. ij.–vi.

Danais fragrans Gaert.—Description.—A liana belonging to the Order of Rubiaceæ, found on the islands of the Indian Ocean.

Parts Employed.—The root and the bark of the stem.

Composition.—Contains a glucoside, danaidin, $C_{14}H_{14}O_5$ (Schlagdenhauffen).

Therapeutical Properties.—The fresh juice is used for cicatrizing wounds. The root is tonic and febrifuge. The wood is used in herpetic eruptions.

Doses.—Decoction of the root (℥ iiss. : O ij.), fl. ʒ ij. at a dose.

Devildora.—Description.—A plant derived from British Guiana.

Composition.—Contains a bitter principle.

Therapeutical Properties.—Considered as a powerful aphrodisiac by the natives and Europeans. Said to be used as an abortifacient by the native women.

Use.—Employed in the form of a decoction or an extract.

Digitalis ambigua Murr.—Description.—A plant belonging to the Order of Scrophulariaceæ, indigenous to Austria; the leaves are pale yellow, having internally brown spots and fine reticulations. The leaves differ from those of Digitalis purpurea by the absence of their remarkable venation, of their soft down, and of their gray color.

Composition.—Paschkis has extracted from these leaves, besides chrysophanic acid, digitaline, digitaleine, digitoxine, and digitonine, identical with those of Schmiedeberg.

Physiological Properties.—The leaves have physiological effects which are qualitatively similar to those of the leaves of D. purpurea, from which they probably do not differ

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quantitatively. The same observation applies to the principles extracted from them.

Therapeutical Properties.—Paschkis has determined that the therapeutical properties are in every way identical with those of Digitalis purpurea and recommends the introduction of the plant into the Austrian Pharmacopœia, because it is common in that country, while D. purpurea is rare.

Use and Doses.—The same preparations and doses as those of digitalis and digitaline.

Ditana digitifolia.—Description.—A plant indigenous to Mexico.

Parts Employed.—Leaves and stamens.

Therapeutical Properties.—P. Guirleo found that the plant sensibly increases the secretion of milk, without causing perspiration.

Use.—Infusion (℥ i.: O ij.).

Dithiosalicylate of Sodium.—Preparation.—Dithiosalicylic acid is saturated with soda.

Description.—A grayish, hygroscopic powder, readily soluble in water; perchloride of iron colors the solution slightly purple; on the addition of an acid, dithiosalicylic acid separates in the form of yellow resinous drops almost insoluble in water.

Physiological Properties.—It rapidly lowers the temperature, except in cases of phthisis.

Bacteriological Properties.—Powerfully antiseptic.

Therapeutical Properties.—Liedenborn has tried the two combinations at the Frankfort hospital in several cases of articular rheumatism. Those of the salt which he designates under No. 2, without indicating its composition, have given results analogous and even superior to those of salicylate of comparable sodium.

Doses.—Gr. iij., morning and evening, in slight cases; if necessary, the dose is repeated several times in the evening at hourly intervals, without untoward results.

Dithiosalicylic Acid.—Preparation.—Obtained by heating to 248–302° F. equivalent quantities of salicylic acid and chloride of sulphur.

Therapeutical Properties.—In some respects analogous to

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those of salicylic acid, but serving mainly as a starting-point for a new series of compounds.

Diuretin.—Synonym: Salicylate of theobromine and sodium.

Description.—A white powder, soluble in water.

Preparation.—Prepared by Knoll.

Therapeutical Properties.—Like caffeine, it has a diuretic effect, but has numerous advantages over caffeine, which are set forth as follows by Schroeder of Strasburg and Gram of Copenhagen: 1. Theobromine produces diuretic effects by its direct action on the kidneys, as demonstrated by Schroeder by comparison between caffeine and theobromine. 2. Theobromine differs from caffeine by the absence of central stimulation, that is to say, contrary to caffeine, it causes no insomnia, agitation, etc., which are inimical to the action on the kidneys and which account for the uncertainty of caffeine. 3. Theobromine is, as it were, a variety of caffeine which lacks the stimulant central action, although it exerts a distinct effect upon the kidneys; theobromine has caused satisfactory diuresis even in cases where digitalis and strophanthus failed. 4. It is inconvenient to exhibit theobromine uncombined. As it only dissolves in about 1,600 parts of water at ordinary temperatures, its absorption is very difficult and it is liable to cause vomiting.

Doses.—About ʒ iss. per day, to be given in divided doses of gr. xv.

Doundaké.—Synonym: Sarcocephalus esculentus Afz.

Description.—A plant belonging to the Order of Rubiaceæ, indigenous to the Senegal.

Composition.—Contains a resin and an alkaloid, doundakine, $C_{28}H_{19}NO_{13}$ (Schlagdenhauffen).

Physiological Properties.—Bochefontaine, Féris, and Marcus have made kown the physiological action of this bark and its alkaloid.

Therapeutical Properties.—Doundaké is an astringent tonic and febrifuge which may take the place of cinchona bark and its alkaloid, the sulphate of quinine.

Recommended in anorexia, gastro-intestinal troubles, anæmia, cachexiæ, scrofula, paralysis, and nervous diseases.

Use and Doses.—Wine (ʒ i. of the powdered bark in ℥ ij.

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of wine). Hydro-alcoholic extract, ♏ iij.–iv. Powdered bark, ʒ ss.–i. Aqueous extract, gr. iij.–viij. Doundakine, gr. iij.–iv.

Duboisia Hopwoodii M.—Synonym: Pituri.

Description.—A ligneous plant, indigenous to Australia and New South Wales.

Composition.—Petit has found an alkaloid, piturine, analogous to nicotine, $C_{12}H_{16}N_2$.

Therapeutical Properties.—An energetic tonic, suitable to cases of extreme debility; Bancroft likens its effects to those of strychnine.

Duboisia myoporoides R. Br.—Description.—A shrub belonging to the Order of Solanaceæ, indigenous to Australia.

Composition.—Contains an alkaloid, duboisine.

Part Employed.—The leaves.

Therapeutical Properties.—Successfully used in diseases of the eye. Dujardin-Beaumetz has substituted it for atropine in the treatment of certain ophthalmias.

The extract has been given with good effects in the night sweats of phthisis, without interfering with the appetite. It causes complete relief in grave cases of vesical tenesmus due to inflammation of the bladder.

Use and Doses.—Duboisine, in collyria, gr. ¾ in ♏ clx. of water. Extract, gr. viij. in ♏ xvi. of water, for hypodermic injection.

Duvaua dependens D. C.—Synonym: Huingan.

Description.—A plant belonging to the Order of Terebinthaceæ-Anacardiaceæ, indigenous to Chili.

Parts Employed.—The fruit, bark, and roots.

Therapeutical Properties.—Recommended in affections of the urinary passages; in that case, the entire plant is employed. The bark is used in rheumatism.

Echujin.—A glucoside derived from Adenium Bœhmianun.

Description.—A plant belonging to the Order of Apocynaceæ, indigenous to south-western Africa.

Composition.—The glucoside named echujin, from the native designation of the plant, echuja, has been isolated by Boehm.

Therapeutical Properties.—A poisonous glucoside, analogous to digitaline in composition, but having rather the phys-

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iological and therapeutical properties of ouabain and of strophanthin.

Elaterium momordica.—Synonym: Wild cucumber.

Description.—A plant belonging to the Order of Cucurbitaceæ, indigenous to Europe.

Part Employed.—The extract from the juice of the fruits.

Composition.—Contains a glucoside, elaterin, which is crystalline, insoluble in water, soluble in alcohol and chloroform. Formula, $C_{20}H_{28}O_5$.

Therapeutical Properties.—A violent, drastic, hydragogue cathartic, used in cardiac affections complicated with lesions of the kidney. Externally it is an irritant, causing pimples and even ulcers.

Use and Doses.—Tincture. Powder, gr. $\frac{1}{8}$–$\frac{2}{3}$. Tincture (1:5), gtt. x.-xxx. Elaterin, gr. $\frac{1}{60}$–$\frac{1}{15}$.

Embellia Ribes Burm.—Description.—A shrub belonging to the Order of Myrtaceæ, indigenous to western India.

Therapeutical Properties.—The seeds are carminative, tonic, and used in dyspepsia and skin diseases. The fruits form a good remedy for tapeworm, according to Harris, of Simla, who claims to have used them with success both in native and European practice.

Doses.—ʒ ij.-ʒ i. of the powdered fruits, administered in milk in the morning before breakfast.

The active principle would be a more convenient mode of administration.

Entada scandens Bent.—Synonyms: Calibeau, Pilpara.

Description.—A plant belonging to the Order of Leguminosæ.

Composition.—Contains a glucoside (A. Petit).

Therapeutical Properties.—A very powerful emetic; used in lumbar pains and in debility.

Ephedrine.—Description.—An alkaloid extracted by Prof. Nagai, of Tokio, from Ephedra vulgaris L., a plant belonging to the Order of Gnetaceæ.

The hydrochlorate crystallizes in needles, is very soluble in water, and its solution is not affected by light.

Therapeutical Properties.—Possesses mydriatic properties; has been tried in 10% solution. It is used for facilitating the

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ophthalmoscopic examination of the eye; the accommodation is easily suppressed by it, while it is harmless for the eye and the patient.

Doses.—Hydrochlorate of ephedrine, in collyria, in doses of gr. ss. in fl. ʒ iij. of distilled water. For instillation, gtt. ij.-iij.

Ergotinine.—Description.—An alkaloid extracted from ergot of rye which crystallizes in small white needles; insoluble in water, soluble in alcohol, ether, chloroform (Tanret); acquires a reddish-violet color changing into blue in ethereal solution to which is added dilute sulphuric acid (1:17).

Therapeutical Properties.—Very effective in hemorrhage (hæmoptysis, epistaxis, uterine or rectal hemorrhage); used also in erysipelas and cerebral affections.

Christian has given it for the epileptic attacks which occur in the course of general paralysis and terminate fatally in a number of cases. Two hypodermic injections suffice to arrest the attacks.

Use and Doses.—Hypodermic injection, prepared as follows:

Ergotinine, ...	gr. ¾.
Lactic acid, ...	gr. ½.
Water, ...	♏ clx.

Five to ten drops of this solution are injected at a dose, or about gr. $\frac{1}{66}$ to gr. $\frac{1}{33}$ of ergotinine.

Erigeron canadense L.—Synonym: Canada fleabane.

Description.—A plant belonging to the Order of Compositæ-Synantherеæ.

The essence of erigeron, a volatile oil, of a clear yellow color, a peculiar herbaceous odor, and an acrid and burning taste, has been used as an adulterant of essential oil of mint. It is soluble in its own weight of 85% alcohol.

Preparation.—Ferd. Vigier has described the means by which the essential oil of erigeron can be separated from other essences sophisticated with it; he has also indicated the modifications this oil undergoes with different reagents.

Therapeutical Properties.—It seems to act as a diuretic, tonic, and astringent; it produces good effects in dropsy, diarrhœa, dysentery, hemorrhages, in the advanced stage of typhoid fever, and in gravel. In America it is used as a hæmostatic.

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Use and Doses.—Potion, gtt. v.–x. Infusion (℥ i. in O ij. of water). Powder, gr. iss.–iij. every hour.

Erythrina Corallodendron L.—Synonym: Colorin.

Description.—A plant belonging to the Order of Leguminosæ, indigenous to Mexico, the Antilles, and Brazil.

Composition.—Francisco Rio de la Loza has extracted an alkaloid, erythrocoralloidine.

Physiological Properties.—Hypodermic injections of the extract (gr. xxx.) dissolved in water cause in animals symptoms of torpor and feebleness which terminate in death at the end of seven or eight hours if the animal is young and not robust.

Therapeutical Properties.—In South America it is commonly used as a hypnotic and sedative for the nervous system.

It has been studied experimentally by Bochefontaine, and clinically by Rey, physician to the Ville Evrard Asylum, also by Rio de la Loza.

In mania with agitation and insomnia, Rey has obtained some hours of quiet slumber with gr. viij. of the extract; by giving this dose two or three times in the night, at two hours' intervals, he has secured quiet sleep.

The drug is also an energetic purgative and a diuretic.

Erythrophlœum guineense Don.—Synonyms: Sassy, Casca, Mancone, Teli.

Description.—A tree belonging to the Order of Leguminosæ-Cæsalpinieæ, indigenous to Guinea and the Congo. The bark bas been studied by Heckel, of Marseilles.

Composition.—Contains erythrophlœine, an alkaloid isolated by Hardy and N. Gallois.

Physiological Properties.—The bark has a special action on the heart which it arrests in systole, and on the mucosæ of the stomach and intestines which are profoundly altered.

The African savages make use of this substance for poisoning criminals condemned to death, and also as an ordeal poison.

Therapeutical Properties.—Dujardin-Beaumetz ascribes to it the same properties as digitalis: a heart tonic and diuretic.

Lewin employs it with good results in collyria and as an anæsthetic for the eyes.

The alkaloid strengthens and quiets the heart; its properties are identical with those of digitaline and picrotoxine.

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Doses.—Tincture (1:10), gtt. v.-x., three times a day. Granules, of $\frac{1}{6\,0}$ grain each, one to two per day.

Eschscholtzia californica.—Description.—A plant belonging to the Order of Papaveraceæ, indigenous to North America and cultivated in California.

Composition.—Contains a small quantity of a principle said to be identical with morphine, another base, and a glucoside.

Therapeutical Properties.—It is a weak soporific, suitable for children and people who cannot bear strong narcotics. The quieting, analgesic effect persists rather long after its administration.

Doses.—Gr. xxxviij. to ʒ iiss. per day.

Ethoxycaffeine.—Preparation.—It is obtained by treating bromide of caffeine with potassa in alcoholic solution.

Description.—Crystalline needles, soluble in water.

Physiological Properties.—Toxic in gr. xv. doses; in gr. viij. doses it causes vertigo, nausea, drunkenness, vomiting, and a burning sensation.

Therapeutical Properties.—More active than caffeine; it possesses a sedative action on the cerebro-spinal system. It is used in migraine and facial neuralgia.

Use and Doses.—It is given in wafers, or in solution with the addition of benzoate of sodium, like caffeine, in doses of gr. iv. Its administration is facilitated by the addition of gr. iss. of cocaine which increases the toleration and prevents the sensation of burning in the pharynx.

Eucalyptol.—Preparation.—From the essential oil derived from the distillation of the leaves of Eucalyptus globulus (Myrtaceæ) with water. Formula, $C_{24}H_{20}O_2$.

The commercial product is unsuitable for hypodermic injection. By passing a current of hydrochloric acid gas into the crude eucalyptol placed in a refrigerating mixture a crystalline mass is obtained which, expressed and dried, and diluted with water, gives, after rectification, the pure product.

Description.—Boiling point, 348.8° F. Specific gravity at 59° F., 0.930.

Test.—In a refrigerating mixture eucalyptol crystallizes in long needles, fusing at 30° F.; this is an easy method of proving its purity.

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Physiological Properties.—A volatile oil, of a peculiar aromatic, warm, frank, and agreeable odor, insoluble in water, soluble in alcohol, ether, fixed and volatile oils.

Therapeutical Properties.—Successfully used in bronchitis and chronic catarrh. A powerful antiseptic for the air-passages.

According to E. Delpech, it is easily eliminated by the respiratory passages and the kidneys.

Used by injection in affections of the ear and of the urethra.

Use and Doses.—Capsules containing ♏ iv. of eucalyptol, in doses of three to five per day.

Eucalyptus Honey.—Description.—Honey secreted by Apis nigra mellifica which feeds on the eucalyptus flowers in Australia.

Composition.—It contains 61.5 parts of sugar, 1.8 of ash, 21.5 of water, 17.1 of eucalyptol, terpene, cymol, a green coloring matter, and a resin.

Therapeutical Properties.—Used in affections of the larynx, bronchi, lungs, heart, typhoid fever, whooping cough, diseases of the bladder and kidneys, and catarrhs. It is very effective in scrofulous affections and serves as a substitute for cod-liver oil.

Dose.—One to three teaspoonfuls in an appropriate liquid.

Eugenia Cheken.—Description.—A plant belonging to the Order of Myrtaceæ, indigenous to Chili.

Therapeutical Properties.—Aromatic, astringent, expectorant, and antiseptic. Used in purulent affections of the bronchi, bronchitis, catarrh of the bladder, etc. In Chili, the fresh leaves are used in eye diseases, the sap being expressed and made into lotions. The bark is antidysenteric.

Use and Doses.—Infusion, ʒ iiss. in ♏ clx. of water, for injection. Syrup, 1 part of the leaves to 2 of syrup. Fluid extract, fl. ʒ ij.-iij., three or four times a day.

Eugenol.—Synonym: Eugenic acid. Formula, $C_{10}H_{12}O_2$.

Preparation.—It is obtained by treating oil of cloves with soda, distilling off the volatile portion, and decomposing the residue with an acid.

Description.—An oily, colorless liquid, having the odor and taste of oil of cloves, insoluble in water, soluble in ether and alcohol.

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Therapeutical Properties.—Antithermic and antiseptic. Used as an anæsthetic in dentistry.

Use and Doses.—Gelatin capsules; potion; enema, ♏ xv. for adults and ♏ iv. for children.

Eulyptol.—Composition.—A complex body consisting of:

Salicylic acid, ...	1 part.
Carbolic acid, ...	1 part.
Oil of eucalyptus, ...	1 part.

Therapeutical Properties.—Recommended by Schmeltz, of Nice, as an antiseptic preferable to iodoform and sublimate.

May be administered internally in acute rheumatism, typhoid fever, pulmonary catarrh, and affections of the urinary passages.

Doses.— ʒ ij.–iiss. per day.

Euonymus atropurpureus Jacq.—Synonym: Wahoo.

Description.—A plant belonging to the Order of Celastraceæ, indigenous to North America.

Composition.—Contains a resin, which, in its impure form, is called euonymin.

Therapeutical Properties.—Laxative and hepatic stimulant.

Euonymin powerfully stimulates the biliary secretion.

Use and Doses.—Fluid extract of the bark, ʒ ss.–iss. Euonymin, gr. ss.–iss.

Eupatorium amarissimum L.—Synonym: Gravel root.

Description.—A plant belonging to the Order of Compositæ-Synanthereæ, indigenous to Canada and Virginia.

Parts Employed.—The leaves and roots.

Therapeutical Properties.—Leaves tonic, bitter, proposed as a substitute for hops. Root bitter, aromatic, and astringent. It is used chiefly as a diuretic.

Euphorbia Drummondi.—Description.—A plant belonging to the Order of Euphorbiaceæ.

Composition.—Reid has extracted an alkaloid from the plant, to which he attributes the same properties as those of cocaine.

Therapeutical Properties.—A 4% solution applied to the tongue, the hand, and the nostrils produces in all cases a notable anæsthesia, without affecting the motor power or acting on the pupil.

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In Australia the plant has been recognized as noxious to animals which die in from one to seven days after partaking of it.

Euphorbia geniculata.—Description.—The Euphorbia of South America which has been introduced, undoubtedly by accident, into Egypt, where it has spread and, like a weed, invaded all the land. The plant has caused the loss of sheep, horses, and oxen in various districts (Prof. Sickenberger).

Composition.—An analysis of the juice has furnished the acid resin characteristic of the Euphorbiaceæ, euphorbone, and caoutchouc.

Therapeutical Properties.—In Egypt, the natives have had the idea of using it medicinally; they eat the young plants or drink the infusion, but not without accidents.

Euphorbia pilulifera.—Description.—A plant indigenous to Australia.

Composition.—Resin, chlorophyll, caoutchouc, tannin, volatile acid, etc.

Physiological Properties.—The active principle is poisonous to warm-blooded animals. The toxic dose (Eloy) would be gr. viij. of the plant for each pound of the animal's weight.

Therapeutical Properties.—For asthma, bronchitis, and other affections of the respiratory passages. The action is slightly narcotic. It acts very energetically, hence should not be used in too concentrated a decoction, for fear of accidents.

Use and Doses.—Decoction, ℥ i. in two quarts of water, boiled down one-half; dose, fl ℥ ij., three times a day. Fluid extract, gtt. x.–xxx.

Euphorbia piscidia.—Synonym: Mata gallina.

Description.—A plant derived from Mexico.

Therapeutical Properties.—Acts as a caustic. Virulent poison. It is used for killing fish.

Exalgin.—Synonym: Methylacetanilid. Formula, $C_9H_{11}NO$.

Description.—Needles or large white tablets, according to whether it has been obtained by crystallization or in bulk after distillation; slightly soluble in cold water, more soluble in hot water, freely soluble in water with a small admixture of alcohol. Fuses at 213.8° F. (Beilstein).

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Physiological Properties.—Administered to an animal, it acts energetically on the cerebro-spinal axis, and in a few minutes causes the death of a rabbit, in a dose of gr. iiiss. for each pound of its weight; it induces phenomena of impulsion, trembling, and paralysis of the respiratory muscles. In non-toxic dose, the sensibility to pain disappears, while the tactile sensibility persists; a gradual lowering of the temperature is observed.

The physiological and toxic effects of exalgin greatly resemble those of antipyrine; but the former seems to act more directly on the sensibility, and less actively on the thermogenic centres (Dujardin-Beaumetz and Bardet).

Therapeutical Properties.—Analgesic effects are obtained by a dose of gr. iv.–vi. taken at once, or of gr. vi.–xij. taken in two portions in twenty-four hours. This analgesic action is very marked and seems to be superior to that of antipyrine in all the varieties of neuralgia, including the visceral form. Thus far, its use has not been followed by the gastro-intestinal irritation, rash, and cyanosis observed from the exhibition of antipyrine or acetanilid, except once a light erythema.

Exalgin is eliminated in the urine, modifies the urinary secretion, and, like the antipyretics of the same group, in diabetic polyuria causes a diminution in the quantity of sugar and in the daily excretion of urine.

To sum up, exalgin is a powerful analgesic, in which respect it appears to be superior to antipyrine; it is, moreover, more active, since it requires only half the quantity. If we compare this product with the other antipyretic analgesics derived from the aromatic series, we find that, like the latter, exalgin is both antiseptic and analgesic, but that this latter property does not seem to dominate in its therapeutic effects (Bardet).

Use and Doses.—Potion, according to Bardet:

Exalgin, ...	gr. xlv.
Spirit of peppermint, ...	fl. ʒ ss.

Dissolve and add:

Syrup, ...	fl. ʒ vi.
Water, ...	fl. ℥ iiiss.

Each spoonful contains gr. iv. of the drug; one to three spoonfuls are given in the twenty-four hours.

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In alcoholic form:

Exalgin, ...	ʒ i.
Rum, ...	fl. ℥ iss.
Distilled water, ...	fl. ℥ iiiss.

In wafers, in doses of gr. iv., repeated two or three times in the twenty-four hours.

Excœcaria cataphracta.—Synonym: Excœcaria Agallocha L.

Description.—A plant belonging to the Order of Euphorbiaceæ, indigenous to Cochin-China.

Therapeutical Properties.—Deobstruent, carminative stimulant, and tonic; moderates the twinges of gout and arrests vomiting. The fresh juice or the decoction of the leaves is used in the treatment of inveterate ulcers.

Fabiana imbricata.—Synonyms: Pichi or Pitché of Chili.

Description.—A shrub belonging to the Order of Solanaceæ, Genus Nicotianeæ, growing abundantly on the frontiers of Chili and Araucania. Cultivated in the neighborhood of Marseilles. It has an odor of vanilla which recalls that of guaiac.

Composition.—Limousin has examined the wood and the bark and has demonstrated the existence of rather large quantities of a resinous substance, of two glucosides, but no alkaloid.

Therapeutical Properties.—In South America, the decoction of the bark is considered as very efficacious, in the form of a draught, for affections associated with pus in the urine. It is said to disintegrate urinary calculi and to favor their expulsion. It is used in catarrh of the urinary passages. Le Menant des Chesnais has demonstrated its antiseptic and sedative properties in acute and chronic catarrh of the bladder.

It is also employed in dyspepsia and dropsy.

It is, moreover, a liver stimulant, used in jaundice and all affections depending on insufficient secretion of bile.

Use and Doses.—Fluid extract, fl. ʒ ij. in a glass of water, three times a day. Decoction, ℥ i. in O ij., to be taken in four portions during the day.

Ficus doliaria.—Description.—A tree belonging to the Order of Urticaceæ, indigenous to Brazil.

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Composition.—Moncorvo has isolated a ferment or vegetable pepsin, doliariin, analogous to papain.

Therapeutical Properties.—Used in Brazil in the treatment of the anæmia due to the presence of a parasite, Anchylostoma duodenale.

Flacourtia cataphracta.—Description.—A plant belonging to the Order of Bixaceæ, indigenous to India and Indo-China.

Part Employed.—The leaves.

Therapeutical Properties.—Tonic and astringent. Dymock recommends it for hoarseness, especially in patients of bilious temperament. It is soothing in nausea and diarrhœa, and is a tonic in cachexiæ.

It is very efficacious in diarrhœa and general debility.

Use and Doses.—Tincture (1:5), in doses of ʒ ss. Infusion, in doses of ʒ ss.

Formyl-amidophenic Ether.

Preparation.—It is obtained from phenacetine, by replacing an acetyl group by a formyl group.

Description.—Brilliant, tasteless scales, soluble in warm water, aclohol, and ether. Fuses at 176.2° F.

Therapeutical Properties.—Antipyretic. It acts directly on the spinal cord, counteracting the effect of strychnine; it is an antidote of strychnine and other convulsant and tetanic poisons.

Franciscea uniflora.—Synonyms: Manaca, vegetable mercury.

Description.—A tree belonging to the Order of Scrophulariaceæ, indigenous to Brazil and Central America.

Composition.—Contains an alkaloid, manacine.

Physiological Properties.—Toxic in large doses.

Therapeutical Properties.—Cauldwell has treated 35 cases of rheumatism with the fluid extract and praises it highly, especially in subacute cases in which the temperature is but slightly if at all elevated. Cauldwell and Gottheil use the fluid extract by preference, in doses of ♏ vi.–xxxij. per day, particularly in chronic rheumatism.

In the United States manaca is used as an alterative and antirheumatic.

The drug is also a powerful antiseptic, antisyphilitic, purgative, emmenagogue, and diuretic.

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Use and Doses.—The powdered root is largely employed, in doses of gr. ix., three or four times a day. Decoction of the root (10 to 15%). Fluid extract, prepared from the root, in doses of gtt. v.–xx., three times a day.

Gelsemium sempervirens.—Synonym: Yellow jasmine.

Description.—A plant belonging to the Order of Loganiaceæ, indigenous to the United States.

Composition.—The active principle is gelsemine, $C_{11}H_{19}NO_2$, which gives reactions analogous to those of strychnine.

Therapeutical Properties.—It is a nervous and arterial sedative, employed in bilious and remittent fevers, delirium, epilepsy, acute blennorrhagia, inflammations of the pleura, neuralgic affections of the trigeminus and the dental nerves. It is very active and must be used with care.

Doses.—Fluid extract, ♏ i. or ij.–iij., three times a day. Powdered root, gr. iss.–ij. Tincture, gtt. v.–xv.

Geranium maculatum L.—Synonym: Alum root.

Description.—A plant belonging to the Order of Geraniaceæ, indigenous to the United States.

Part Employed.—The root.

Therapeutical Properties.—Powerful astringent, indicated in chronic diarrhœa and cholera infantum, hemorrhages, ulcers of the pharynx and buccal cavity. Shoemaker claims that it is very useful in hæmoptysis, and internal and external hemorrhages.

Use and Doses.—Powdered root, gr. xv.–xxx. Decoction (℥ i. in fl. ℥ xx. of water), in doses of fl. ℥ ij. Fluid extract, gr. xx.–xxx. Geranine, gr. ¼ to iv.

Gogo.—Synonyms: Phrynium Beaufnetzii Heck., Dadi-Gogo.

Description.—A plant belonging to the Order of Marantaceæ indigenous to the western coast of Africa.

Part Employed.—The rhizome.

Therapeutical Properties.—The drug only acts in the fresh condition, but it is a powerful vermifuge and purgative, employed with success by the natives of the Senegal and the Gaboon.

Use.—Maceration or decoction:

Rhizome, ...	℥ iiss.
Water, ...	O i.

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Gossypium herbaceum L.—Synonym: Cotton plant.

Description.—A plant belonging to the Order of Malvaceæ.

Therapeutical Properties.—Its action equals that of ergot. The extract excites uterine contractions even more certainly than the latter. It is used in amenorrhœa and dysmenorrhœa.

Doses.—Fluid extract, ʒ i. to ℥ ss. per day. Infusion, ʒ iiss. of the bark, twice a day. Decoction, ℥ iv. in O iiss. of water, fl. ℥ ij. every half-hour.

Gouania domingensis.—Synonym: Jamaica chewstick.

Description.—A plant belonging to the Order of Rhamnaceæ, indigenous to the Antilles.

Parts Employed.—The stem and the bark.

Composition.—Contains saponin and a bitter principle.

Therapeutical Properties.—Used as a tonic in dyspepsia and pulmonary affections. In the United States, it is sometimes chewed after meals, to facilitate digestion.

The powder, recommended as a dentifrice, hardens the gums and sweetens the breath. It makes an astringent and agreeable gargle.

Gray Oil.—Description.—A mixture of lanolin and mercurial ointment, liquefied by the addition of olive oil.

Preparation.—The first formula, that of Lang, consists in extinguishing three parts of mercury in three parts of lanolin; at the end four parts of olive oil are added. It contains 30% of mercury.

Nesser extinguishes the mercury according to the method of Lebœuf, by mixing ʒ v. of mercury with ℈ iv. of ethereal tincture of benzoin; then he adds ʒ x. of liquid vaselin.

Beausse has published a good formula. His process consists in extinguishing ʒ v. of mercury by agitation with ℈ iv. of tincture of benzoin in a flask of 10 oz. capacity; after extinction he decants the tincture and divided mercury, and triturates with ʒ x. of liquid medicinal vaselin, or rather with a mixture of liquid and ordinary vaselin, according to its consistence. He rinses the flask with ether, adds this to the ointment, and triturates anew. It takes five hours of trituration to make the preparation perfect.

These formulæ for the preparation of gray oil require the

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expenditure of several hours' labor, which is out of proportion to the value of the product obtained.

P. Vigier has published a method which requires only fifteen minutes. Take:

Solid white vaselin, ...	gr. xxxviij.
Mercurial ointment (Codex), . .	gr. xxiv.
Mercury, ...	ʒ v.

Introduce the whole into a slightly warmed porcelain mortar; triturate for fifteen minutes to extinguish the mercury. Then add ℈ vss. of white solid vaselin and ʒ v. of liquid vaselin. Mix with care and put the product into a wide-mouth bottle with ground-glass stopper, previously washed with alcohol. The gray oil thus prepared is sufficiently fluid and contains 40% of mercury.

Therapeutical Properties.—Recommended as antisyphilitic by Lang and Balzer.

Use and Doses.—Injections of Vigier: Inject every week for about two months $\frac{8}{10}$ of a syringe, corresponding to gr. 1¼ of mercury. Therefore, from ʒ i. to ℈ iv. will suffice for the treatment. Deep subcutaneous injections according to Balzer, in doses of $\frac{8}{10}$ of a syringe, once a week.

Grindelia robusta Nut.—Description.—A plant belonging to the Order of Compositæ-Synanthereæ, indigenous to California.

Parts Employed.—The leaves and flowering tops.

Composition.—The resin is said to be the active part.

Therapeutical Properties.—Used in whooping cough, spasmodic asthma, and bronchial affections. It is effective in lessening the frequency and violence of the attacks. It is a specific for the irritation caused by the sap of Rhus toxicodendron, and for the irritation of certain skin diseases.

C. Paul has used it with success in emphysema.

Doses.—The fluid extract must be given in sweetened water or milk, while stirring the mixture, to prevent the resin adhering to the glass, in doses of ʒ ss.-i., every three or four hours. Tincture (1:5), gtt. xxx.-xl.

Guachamaca toxifera.—Synonym: Malouetia nitida Spr.

Description.—A plant belonging to the Order of Apocynaceæ, indigenous to Venezuela.

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Composition.—Scheffer has isolated an alkaloid, guachamacine, insoluble in absolute alcohol.

Part Employed.—The bark.

Physiological Properties.—Very toxic; the effect of the aqueous extract of this plant resembles that of curare in its paralyzing action, but differs from it by not affecting the respiratory organs (Sachs and Scheffer).

Therapeutical Properties.—It is used in tetanus, hydrophobia, and the spasms occurring in nervous affections.

Guaco.—Synonyms: Mikania Guaco H. B., Eupatorium saturejæfolium Lam.

Description.—A climbing plant growing in South America, in Venezuela and Colombia.

Composition.—Contains a bitter resinoid substance, guacin.

Part Employed.—The entire plant.

Therapeutical Properties.—Employed in snake-bite, intermittent fevers, rheumatism, gout, hydrophobia, syphilis, and cholera.

Use and Doses.—The fresh juice, as a prophylactic (?) on the wound. Fluid extract, ♏ xvi.–xlviij. Infusion, ʒ v. in O ij. Tincture (1:6), ʒ ss.–i. Ether-alcohol tincture, for external use.

Guarea trichilioides.—Description.—A plant belonging to the Order of Meliaceæ.

Part Employed.—The bark.

Therapeutical Properties.—Emetic and powerful purgative, employed in homœopathic practice.

Guaiacol.—Formula, $C_7H_8O_2$.

Preparation.—Derived from the fractional distillation of beech tar which contains it in large quantity, up to 90%. It distils between 392 and 401° F.; it is purified by combining it with ammonia, then dissolving it in an equal volume of ether, and adding a concentrated alcoholic solution of caustic potassa until it is slightly in excess. The precipitate which forms is washed with ether, allowed to crystallize in alcohol, and finally decomposed by dilute sulphuric acid.

Description.—It appears in the form of a liquid with an agreeable aromatic odor, boiling at 392° F.; sp. gr. 1.1171; with sulphuric acid it gives a clear rose color.

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When exposed to light, it gradually turns yellow.

Therapeutical Properties.—Recommended by Sahli in place of beech-tar creosote, which is always found more or less pure.

Use and Doses.—Guaiacol is used like creosote.

Guaiacol,	♏ xxv.
Alcohol,	fl. ʒ vi.
Water,	fl. ℥ vi.

One tablespoonful after each meal. Pills and capsules of guaiacol, in doses of gr. $\frac{1}{12}$ to $\frac{1}{6}$.

Guaycurru.—Synonyms: Baycurru, Statice brasiliensis.

Description.—A plant belonging to the Order of Plumbaginaceæ, indigenous to Brazil, the Argentine Republic, and Chili.

Part Employed.—The root.

Therapeutical Properties.—Molina considers it as the most powerful astringent in the vegetable kingdom, and uses it in dysentery and atonic ulcers.

Use and Doses.—Externally, fomentations.

Internally, inhalations. Decoction (gr. xv. in O ij. of water), to in doses of fl. ℥ i. Tincture (1:8), ʒ ss.–i.

Guazuma ulmifolia Desf.—Description.—A plant belonging to the Order of Malvaceæ, indigenous to the Antilles and Brazil.

Part Employed.—The bark.

Therapeutical Properties.—A mucilaginous astringent, in the form of a syrup, in thermic fevers. Depurative in cutaneous diseases, scabies, and affections of the hairy scalp. In Brazil, it is used locally in ulcers and wounds.

Use and Doses.—Decoction, ℥ i. of the bark boiled for half an hour in a pint of water.

Gurjun Balsam or *Gurjum.*—From Dipterocarpus lævis Gaert.

Description of Source.—A tree belonging to the Order of Dipterocarpeæ, indigenous to India, Cochin-China. It exudes a viscous and fluorescent balsam having the odor of copaiba.

Composition.—Flückiger has analyzed the drug and found an essential oil, $C_{20}H_{32}$; an acid resin which contains gurjunic acid, $C_{44}H_{64}O_5 + 3H_2O$; and an indifferent resin, $C_8H_{46}O_2$.

Therapeutical Properties.—First recommended by C.

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Shaughnessy, subsequently popularized in France by Natton. It is a substitute for copaiba in blennorrhagic affections. The balsam is also very useful in pulmonary catarrh and in mucopurulent affections of the bladder.

It is used externally in lepra. Vidal, of the Hôpital Saint-Louis, considers it the best local remedy in leprous ulcers.

Use and Doses.— 3 ss.- 3 i. In capsules, bolus, or emulsion as follows:

Gurjun balsam,
Lime water, ... āā equal parts.

This emulsion is spread on pledgets of charpie with which the leprous ulcers are dressed.

Gymnema silvestre R. Br.—Description.—A plant belonging to the Order of Asclepiadaceæ, indigenous to the Dekkan, Assam, and the coast of Coromandel.

Composition.—The leaves contain six per cent of gymnemic acid joined to a base not yet determined.

Therapeutical Properties.—The powdered bark has long been used by the natives for the bite of vipers, and a decoction of the same drug is applied to the wounds in the form of cataplasms.

Its effects are analogous to those of ipecac.

One remarkable property of the leaves is, that when chewed the taste for sweet and bitter substances is lost for from two to twenty-four hours.

Habzelia ethiopica D. C.—Synonyms: Unona ethiopica Dun, Hinteah.

Description.—A plant belonging to the Order of Anonaceæ, indigenous to northern Africa.

Therapeutical Properties.—The seeds are used in smallpox. The stems act as a stimulant to the mucous membranes. The fruit is employed, like cubebs, in blennorrhagia and diphtheria.

Hamamelis virginiana Lam.—Synonym: Witch hazel.

Description.—A tree belonging to the Order of Saxifragaceæ-Hamamelideæ, indigenous to the United States.

Part Employed.—The leaves, collected in autumn.

Composition.—Contain a resin, and a bitter principle.

Physiological Properties.—This drug must be used with

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caution. Circulatory derangements have been observed in several cases in which the dose of gtt. xx. a day has been exceeded. The first symptoms observed are general: yawning, hypersecretion of saliva, nasal mucus, and tears; sight becomes dim, the limbs tremble; cold sweats break out; then derangements of the circulation become apparent: pulse small, often barely to be felt, with frequent intermissions; the heart-beats, frequent and accelerating, suddenly cease; the heart sounds are often heard with difficulty; the patient has a tendency to syncope. Diffusible stimulants act well under such circumstances.

Therapeutical Properties.—Tonic, astringent in hemorrhoids and hemorrhages. The action is decongestive, sedative, regulating the circulation by acting on the vaso-motor, dilator, and constrictor system; this explains its hæmostatic effect in blood stasis, in deep or superficial varicose dilatations.

Doses.—Fluid extract ʒ i.–ij., three times a day. Decoction, ℥ iiss. in O i., one wineglassful per day. Extract, gr. xv. in fl. ℥ xij., gtt. x. every two hours. Tincture from the leaves (1:5), for external use, gtt. v.–xx. per day. Tincture from the bark (1:20), pure or diluted with water, for external use on compresses.

Haya Poison.—Derived from the Somali land and named after John Hay, of Aden.

Composition.—Lewin has found in it traces of erythrophlœum bark (which see).

Physiological Properties.—Lewin has shown that this poison possesses powerful local anæsthetic properties, which he has also discovered in erythrophlœine. These results have been questioned, but they have been confirmed in France, Germany, Austria, etc.

Therapeutical Properties.—Its action persists longer than that of cocaine, but it cannot be used in ophthalmology, as the alkaloid has not yet been obtained perfectly pure.

Doses.—The solution must be weak, from 0.01 to 0.02%.

Heliotropum indicum L.—Synonyms: Indian turnsole, Yerba de Cotona.

Description.—A plant belonging to the Order of Boraginaceæ, indigenous to Porto Rico, India, and Cochin-China.

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Therapeutical Properties.—The sap is used to disperse painful furuncles or anthrax.

A specific in aphthæ and ulcerations of the mouth and pharynx. Amadeo has used it in pharyngitis and angina tonsillaris, with good results regarding the pain and the constriction.

Use.—Infusions internally. Gargles.

Heracleum lanatum Mich.—Synonym: Masterwort.

Description.—A plant belonging to the Order of Umbelliferæ, indigenous to the United States.

Therapeutical Properties.—The stalk, when fresh, is rubefacient. The root is recommended as a carminative stimulant, especially in epilepsy; it is diuretic and expectorant.

Doses.— ʒ iss.-ij.

Hippurate of Lime.—Soluble in twenty-seven times its weight of water.

Use [see Hippuric Acid] and Doses.—Potion, in doses of gr. iv.-xv.

Hippurate of Lithium.—Very soluble in water.

Use and Doses.—Potion, in doses of gr. iv.-xv.

Hippurate of Sodium.—Very soluble in water.

Use and Doses.—Potion, in doses of gr. iv.-xxiv.

Hippuric Acid.—Formula, $C_9H_9NO_3$.

Preparation.—This acid is precipitated from the urine of herbivora by a great excess of hydrochloric acid. It is purified by treating with milk of lime, the solution is filtered, brought to the boiling point, and treated with carbonate of potassium and then with chloride of calcium. After filtering and cooling, hydrochloric acid is added, when the product is obtained in a pure state.

Therapeutical Properties.—Employed with success in the form of salts (see Hippurates) in gout, gravel, calculi, and rheumatism. It is a solvent of urates, especially by the addition of an alkaline citrate.

Hoang-nan.—Synonym: Strychnos Gauthieriana.

Description.—A plant belonging to the Order of Loganiaceæ, indigenous to Tonkin.

Composition.—Contains strychnine, brucine, and igasurine.

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Physiological Properties.—Possesses the physiological properties of strychnine together with those of curarine (exaggeration of reflex movements, cramp, rigidity, and slight trismus).

Therapeutical Properties.—Reputed to be very efficacious in hydrophobia, leprosy, and the venom of serpents.

Barthélemy, of Nantes, has tried the drug in France, and has cured [?] a certain number of cases of hydrophobia with it. He found that the first stages of the disease ran their course, but actual hydrophobia and death were averted.

Use and Doses.—Powder, in gr. xij. dose. Hydro-alcoholic extract, in doses of ♏ v. in twenty-four hours.

Holarrhena antidysenterica Wall.—Synonyms: Holarrhena africana D. C. [?], Conessie, Codaga-pala.

Description.—A plant belonging to the Order of Apocynaceæ, indigenous to India.

Composition.—The alkaloid conessine ($C_{12}H_{20}N$) has been obtained from the seeds by Schirmer and Pottsdorff and identified with the conessine extracted by Haines from a species of Wrightia [formerly called antidysenterica]. Warnecke, however, assigns to the base from Wrightia the formula $C_{11}H_{18}N$ and calls it wrightine; according to this, the two alkaloids would be homologous. The conessine extracted from Holarrhena antidysenterica appears in the form of white, tangled crystals, fusing at 249.8° F.; this conessine is slightly soluble in water, but soluble in alcohol, ether, and chloroform.

Parts Employed.—The seeds and bark.

Therapeutical Properties.—Said to be a specific in diarrhœa, dysentery, and hemorrhages. It is also an antiseptic. Its antipyretic properties are not inferior to those of cinchona. It causes neither nausea, nor vomiting, nor headache. It is also used as a vermifuge, and as a tonic in nephritic colic. Wrightia "antidysenterica," on being substituted for it on trial, was found quite inert.

Doses.—Seeds, gr. iss.-ivss. per day. Tincture (1:5), ♏ xvi. to fl. ʒ i.

Huamanripa.—Synonym: Cryptochæte andicola R.

Description.—A plant belonging to the Order of Compositæ, indigenous to Chili and Brazil.

Composition.—Contains an essential oil and a resin.

Physiological Properties.—The infusion acts as a bitter

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and aromatic, stimulates the circulation, the heart-beats, and the secretions, particularly the saliva. In large doses it causes vomiting, profuse sweats, and diminished respiration and circulation.

Therapeutical Properties.—In its habitat it is valued as a specific in affections of the respiratory apparatus. The Indians use it in hæmoptysis (Bignon).

Use.—Infusion, ʒ i. of the leaves in fl. ʒ viij. of water.

Hura crepitans L.—Synonym: Sand-box tree.

Description.—A plant belonging to the Order of Euphorbiaceæ, indigenous to the Antilles, tropical America, and Brazil.

Therapeutical Properties.—An energetic poison, used as an emeto-cathartic, hydragogue, and externally as a rubefacient. The sap of the plant, when brought into contact with the eye, may cause almost instant blindness. The extract from the bark is used in Brazil against leprosy.

Hydracetin.—Synonym: Acetylphenylhydrazine.

Preparation.—One part of anhydrous acetic acid is mixed with two parts of phenylhydrazine; the mass becomes hot and on cooling deposits crystals of hydracetin.

Description.—A crystalline, white, odorless, almost tasteless powder, fusing at 262.4° F., soluble in 50 parts of water, readily soluble in alcohol, chloroform, and benzin; it reduces alkaline solutions of copper in the cold, and also precipitates metallic silver from alkaline solutions; it reduces mercuric and ferric salts; added to a solution containing ferricyanide of potassium and perchloride of iron, it immediately evokes the Prussian blue reaction; it decolorizes permanganate of potassium solution and precipitates metallic platinum from its chloride. Guttmann thinks that this reducing power must bear some relation to its antipyretic and calmative powers.

Therapeutical Properties.—Guttmann states that it has, in small doses, a remarkable antipyretic action, and produces favorable effects in articular rheumatism; he has also used it with success in psoriasis.

Doses.—A 10% ointment, gr. ¾ to iij. per day. Guttmann advises to use only gr. iss. in two doses and watch the effects, as the medicament must not be continued long.

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Hydrangea arborescens L.—Description.—A plant belonging to the Order of Saxifragaceæ, indigenous to the central and southern United States.

Part Employed.—The root.

Composition.—Contains albumin, starch, resin, salts, and a crystalline glucoside isolated by Schroeter, hydrangin, $C_{34}H_{25}O_{11}$ [?].

The alcoholic extract of the root is treated with a 1% solution of sulphuric acid; the liquid obtained is agitated with chloroform which separates some coloring matter, then with ether which extracts the glucoside. After purification it presents the following characteristics: it melts at 442.4° F.; it dissolves in concentrated sulphuric acid with a reddish-violet fluorescence; in alkalies, with an intense opaline blue color; in 80% acetic acid, with a light fluorescence which becomes more apparent on dilution with five to ten volumes of water.

Physiological Properties.—Aromatic, pungent to the taste.

Therapeutical Properties.—Edson and Green ascribe to it a favorable effect in gravel and diseases of the urinary passages.

Use and Doses.—Decoction, ʒ iiss. in O ij. of water.

Hydrastine.—Preparation.—The solution of crude hydrastine [remaining after the preparation of berberine] in dilute hydrochloric acid is precipitated with ammonia, allowed to dry in the air, and the precipitate dissolved in the smallest quantity needed of warm chloroform; after filtration it is diluted with cold alcohol, and agitated for several minutes. The hydrastine, separated in the form of a crystalline precipitate, is washed with cold alcohol, dried, again taken up with chloroform and treated as before; finally it is recrystallized from boiling alcohol (Eberhart).

Professor Schmitt has ascertained that oxidizing agents transform hydrastine into opianic acid and hydrastinine when acting on an acid solution; but from an alkaline solution hemipinic and nicotinic acids are obtained; these constitute so many points of resemblance with nicotine; it has not yet been possible to transform the one into the other.

Physiological Properties.—See Hydrastis.

Doses.—Gr. iss.-ivss. per day.

Hydrastinine.—Preparation.—Will prepares this sub-

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stance by slightly heating hydrastine with dilute nitric acid and precipitating the product with an alkali.

Physiological Properties.—It is preferable to hydrastine on account of its stimulant action on the cardiac muscle and the persistent constriction it produces in the vascular walls. It is not irritating.

Therapeutical Properties.—Used in metrorrhagia, metritis, pyo-salpingitis, myomata, and endometritis.

Use and Doses.—By subcutaneous injection:

Hydrochlorate of hydrastinine, . .	gr. xv.
Water, ...	fl. ʒ iij.

From one-half to one hypodermic syringeful.

Hydrastis canadensis L.—Synonym: Golden seal.

Description.—A plant belonging to the Order of Ranunculaceæ, indigenous to North America.

Physiological Properties.—After the administration of Hydrastis canadensis or its alkaloid, hydrastine, the heart-beats are slowed; after large doses, arhythmia ensues at times; the slowing following a moderate dose ceases after cutting the vagus nerves; this is not the case with the arhythmia and retardation which follow large doses.

Therapeutical Properties.—Has a distinct effect on the functional disturbances of the utero-ovarian apparatus and anomalies of menstruation.

It is used as a tonic and antiperiodic in intermittent fevers, as a good substitute for cinchona. It is laxative, cholagogue, and used in chronic affections of the mucosæ and in hemorrhoids. It is alterative and antiseptic.

Use and Doses.—The rhizomes and roots are used in the preparation of a fluid extract, and a tincture.

Dose of fluid extract, ♏ xvi. to fl. ʒ i., two or three times a day. Powdered root, ʒ ss.–ij.

Hydrate of Amylene.—Synonyms: Pseudo-amylic alcohol, dimethyl-ethyl-carbinol. Formula, $C_5H_{12}O$.

Preparation.—By the action of sulphuric acid on amylene, which is prepared by the action of chloride of zinc on the amylic alcohol of fermentation. The sulphuric acid employed for the reaction is diluted with one-third of water. Elevation of temperature must be avoided.

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Description.—A mobile, colorless liquid, of a peculiar aromatic odor, and a refreshing taste like mint. Sp. gr. ab. 0.815. Boiling point, 216.5° F. Soluble in alcohol and slightly soluble in water.

Its chemical position is that of a tertiary alcohol.

Therapeutical Properties.—Hypnotic, intermediate between chloral and paraldehyde; it acts neither on the stomach nor on the heart.

Use and Doses.—Potion. Capsules of ♏ vi.–ix. at a dose, and fl. ʒ i.–ij. per day. Enema, in ʒ i. dose.

Hydrated Sulphide of Zinc.—Preparation.—Pass a current of sulphuretted hydrogen through a solution of sulphate or chloride of zinc, in presence of acetate of sodium.

Description.—A white, lumpy precipitate, insoluble in water and alkalies, soluble in mineral acids, insoluble in acetic and organic acids.

Therapeutical Properties.—Barduzzi recommends it for internal administration in cutaneous affections, particularly those in which the function of the skin is to be stimulated (chronic eczema and psoriasis). It is also successfully applied externally; it is readily absorbed by the skin and is not irritating.

Use and Doses.—Externally, ointment:

Lard,	6 parts.
Lanolin,	4 "
Sulphide of zinc,	2 "

Internally, pills:

Washed hydrated sulphide of zinc,	gr. viij.
Extract of gentian,	q. s.

To make fifty pills; from three to twelve to be taken per day.

Hydrochlorate of Orexin.—Synonym: Hydrochlorate of phenyldihydrochinazoline.

Preparation.—To one part of formanilide in solution are added ten parts of pure benzin and one part of sodium; the mixture is heated for ten hours in a reflux condenser. Then one-half part of chlorinated ortho-nitrotoluene is added, and the ebullition continued for one hour. After being washed with water, it is distilled in a current of steam; the residue of

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the distillation, mixed with ether-alcohol, crystallizes. This constitutes orthonitro-toluene formanilide which is treated in alcoholic solution, first with zinc and hydrochloric acid, then with an excess of soda lye. The liquor emits an ether, chinazolin, $C_{28}H_{12}N_2$.

It crystallizes and forms salts; the salt used therapeutically is the hydrochlorate.

Therapeutical Properties.—Orexin is slightly bitter, leaves a burning sensation, and irritates the nasal mucosa. Penzold has recommended it as a medicament capable of stimulating the functions of the stomach.

Use and Doses.—Wafers. Pills, in a large quantity of water or other liquid, in doses of gr. ivss.–viij., once or twice a day.

Hydrocotyle asiatica L.—Synonyms: Indian pennywort, Bevilacqua.

Description.—A plant belonging to the Order of Umbelliferæ.

Part Employed.—The entire plant.

Composition.—Contains, according to Lépine, vellarin, a yellow oil which is supposed to be the active principle [Flückiger could not confirm this.—*Transl.*]; two resins, and a saccharine extract.

Therapeutical Properties.—The alcoholic extract is employed as a depurant and alterative in leprosy and elephantiasis; it has given excellent results in the treatment of ulcerating syphilides.

Use and Doses.—Powdered plant, gr. viij. Fluid extract, gtt. x. Decoction, ʒ ij. to ℥ i. in O ij., boiled down to fl. ℥ vi., three wineglassfuls per day.

Hydrofluoric Acid.—Therapeutical Properties.—A powerful antiseptic and antifermentative; its use has given good results in pulmonary tuberculosis, diphtheria, and in the dressing of indolent wounds. It should be employed with caution if the patient be asthmatic, hemoptysic, or emphysematous (E. Chevy).

J. Bergeron has given it by inhalation in diphtheria, with good results.

Dujardin-Beaumetz, after inquiry among the industries in which this acid is employed for etching glass, has demon-

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strated that the vapors are not only innocuous, but rather exert a favorable effect on laborers suffering from pulmonary complaints. This result led him to institute experiments which enabled him to affirm that this acid is one of the most powerful antifermentatives known; in the experiments of Dujardin-Beaumetz and Chevy an infinitesimal quantity sufficed to arrest fermentations.

C. Paul recommends a titrated concentrated solution of bifluorhydrate of ammonia. It does not attack the glass, and by forcing air through this liquid it may be charged with hydrofluoric acid and thus be inhaled by the patient.

Doses.—External use, ♏ xxv. in ℥ vi. of water. Internal use, by inhalation.

Hydronaphthylamine.—Synonym: Tetrahydro-beta-naphthylamine. Formula, $C_{10}H_7H_4.NH_2$.

Physiological Properties.—Among other interesting properties, this substance seems to possess that of dilating the pupil in a remarkable degree. According to Professor Filehne, of Breslau, the instillation of a weak solution (1 to 5%) produces dilatation of the pupil of the eye experimented on, but great dilatation is produced in both eyes whenever a sufficient quantity, although a minimal one, has been absorbed in some manner, say by hypodermic injection. The pupils are more widely dilated than after atropine, and a pupil dilated ad maximum by atropine, opens still more under the action of this substance.

Hydroxylamine.—Synonym: Oxyammonia. $NH_2—OH$.

Description.—This is ammonia in which one hydrogen atom is replaced by the hydroxyl group; a colorless and odorless body; its hydrochlorate, which crystallizes well, is hygroscopic and very soluble in water, alcohol, and glycerin; its solution must not color phenolphthalein nor strongly redden Congo paper. This last reaction would indicate an excess of free acid.

Therapeutical Properties.—It has been proposed to substitute hydroxylamine, which does not stain the skin, for pyrogallic acid and chrysarobin, in the treatment of skin diseases.

Hygrine.—Preparation.—Extracted from coca leaves, by exhausting the residues which have served for the preparation of cocaine.

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Physiological Properties.—Said to produce dilatation of the pupil at least equal to that of atropine, but more persistent and which ceases immediately after the application of eserine. Unlike cocaine, it possesses no anæsthetic power.

Hymenæa Courbaril.—Synonym: Locust Tree.

Description.—A plant belonging to the Order of Leguminosæ, indigenous to South America.

Therapeutical Properties.—The fluid extract from the bark is a good arterial sedative and astringent, in cases of hæmoptysis, hæmaturia, bloody expectoration, diarrhœa, and dysentery.

Use and Doses.—Fluid extract, gtt. x.-xx.

Hymenodictyon excelsum Wall.—Description.—A plant belonging to the Order of Rubiaceæ, Tribe Cinchoneæ, indigenous to India.

Composition.—According to Naylor, contains hymenodictyonine, a bitter alkaloid.

Part Employed.—The bark.

Therapeutical Properties.—It is astringent and bitter. It is said to be a tonic and febrifuge.

Hyoscine.—$C_{17}H_{23}NO_3$.

Preparation.—An alkaloid isomeric with hyoscyamine, extracted from henbane, and with duboisine. It forms the active part of the amorphous commercial hyoscyamine.

Description.—Ladenburg has shown that atropine, hyoscyamine, and hyoscine, when pure, are isomeric alkaloids. Pure hyoscine is a syrupy liquid; atropine and hyoscyamine, both solid, have different fusing points.

The following salts are used therapeutically: hydrobromate, white prisms, slightly soluble in water; hydrochlorate, large colorless plates, soluble in water; hydriodate, same properties.

Physiological Properties.—The physiological action of hyoscine, as a sedative, is five times stronger than that of atropine and of hyoscyamine; probably the toxic properties stand in the same relation. Without acting on the respiration, this alkaloid raises the circulation and the number of the heartbeats. It dilates the pupil.

Therapeutical Properties.—Antispasmodic, narcotic, and

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cerebral sedative, used in insomnia, delirium, acute mania, and delirium tremens.

Used in ophthalmology as a mydriatic; its antagonists are caffeine and pilocarpine.

Martindale claims that it is a mistake to ascribe to hyoscine properties analogous to those of hyoscyamine, as some physicians have done.

Use and Doses.—Solution:

Solution of hydrobromate of hyoscine, .	♏ xvi.
Distilled water, ...	fl. ℥ viss.

Hypodermic solution:

Hyoscine, ...	gr. $\frac{1}{18}$.
Acidulated water, ...	♏ clx.

In doses of ½ syringeful.

Potion, gr. $\frac{1}{64}$ to $\frac{1}{20}$ per day. Pills, in the same doses. Granules of gr. $\frac{1}{150}$, from one to six per day. External use, collyria.

Hyoscyamine.—Formula, $C_{17}H_{23}NO_3$.

Description.—An alkaloid extracted from henbane seeds and which is also present in Belladonna, Stramonium, and Scopolia. Crystallizable, deliquescent, of a bitter and acrid taste. Soluble in 120 times its weight of water, readily soluble in alcohol, very soluble in ether and chloroform. Fuses 240.8° F. Forms salts with acids.

Ladenburg finds this alkaloid to be identical with duboisine and daturine, and isomeric with atropine. It is actually present only in henbane and in belladonna; the other plants furnish it merely by the decomposition of their alkaloids.

Preparation.—Care must be taken to remove all fatty matter by bisulphide of carbon.

It is decomposed by boiling alkalies into hyoscine and hyoscic acid.

Therapeutical Properties.—Mydriatic, more active than atropine, and much used in ophthalmology. Employed internally in paralysis agitans, mercurial or senile tremor, neuralgia, acute mania, chorea, delirium tremens, insanity, and epilepsy. In very small doses it is used as a narcotic and sedative.

Use and Doses.—External use, collyria, in doses of gr. $\frac{3}{4}$ in

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water fl. 3 vss., to which a few drops of hydrochloric acid are added for solution. Internal use, granules of gr. $\frac{1}{130}$, increasing progressively to gr. $\frac{1}{8}$, provided no toxic symptoms are produced. Subcutaneous injection:

Hyoscyamine, ...	gr. $\frac{1}{4}$.
Distilled water, ...	fl. 3 ij.

Dose for injection, gtt. i.–iv.

Hypnal.—Synonyms: Chloral-antipyrine, trichloracetyl-dimethylphenylpyrazolone.

Preparation.—This body is obtained by mixing chloral hydrate and antipyrine; an oil results which presently congeals into crystals; these are air-dried and purified by recrystallization from water.

Description.—Reuter has made known the combination of one molecule of antipyrine and one molecule of anhydrous chloral; this substance does not give the red reaction with perchloride of iron. Béhal and Choay have effected the combination of one molecule of antipyrine with one molecule of chloral hydrate, and of one molecule of antipyrine with two molecules of chloral hydrate. These two compounds give the red reaction with perchloride of iron.

Therapeutical Properties.—Reuter's compound is therapeutically inert, while those of Béhal and Choay are active. Hence the perchloride of iron test should first be made. Bardet recommends hypnal for insomnia due to pain and cough. It is easily administered to children, as it is tasteless.

Dose.—Gr. xv.

Hypnone.—Synonyms: Phenylmethyl-acetone, acetophenone. Formula, according to Wurtz, $C_6H_5—CO—CH_3$.

Preparation.—This substance belongs to the aromatic series; Friedel obtained it by making chloride of benzoyl react upon zinc methyl or by distilling a mixture of benzoate and acetate of calcium.

Description.—A colorless, mobile, very refractive liquid, boiling at 388.4° F. It is volatile, and its odor, which is very tenacious and persistent, recalls that of essence of bitter almonds or that of cherry-laurel water. It is not directly inflammable, but aids in the combustion of bodies impregnated with it. At about 39 or 41° F. it solidifies into a mass of felted crystals which persist to a temperature of 53.6 to 59° F. Its

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specific gravity is 1.032. It is not soluble in water nor in glycerin. Its reaction to litmus paper is neutral. Very soluble in alcohol, ether, chloroform, benzin, oils, and particularly in oil of bitter almonds; which latter fact suggested the idea of administering it in capsules after being dissolved in this vehicle.

Physiological Properties.—In Guinea-pigs a subcutaneous injection of the pure drug, in doses of gr. viij.–xv., leads to a comatose form of somnolence, followed by the death of the animal in five or six hours after injection (Dujardin-Beaumetz).

Constantin Paul and Huchard have also experimented with this medicament and have arrived at very similar conclusions.

Therapeutical Properties.—Dujardin-Beaumetz was the first to demonstrate its hypnotic properties which had escaped Popoff and Nencki.

Use and Doses.—The dose varies from gtt. iv.–xvi., about gr. iss.–vi., and this dose always produces four to six hours of healthy sleep (Dujardin-Beaumetz).

The dose must be administered at once in order to obtain a well-marked hypnotic effect; it should be proportionate to the age and temperament of the patient.

In his first trials Dujardin-Beaumetz administered hypnone diluted with alcohol, ether, or glycerin in capsules.

The dosage being now ascertained, Limousin thinks it preferable to give the drug in gelatin capsules, thus:

Hypnone, ... gtt. iv. or gr. iss.
Oil of sweet almonds, . . . q. s. for one capsule.

Thus we avoid the ingestion of a certain quantity of alcohol of 90% or of a proportionately large dose of ether, considering that hypnone is administered in doses of a few drops only.

Oil of sweet almonds possesses the property of moderating to a great extent the penetrating odor of hypnone.

Hysterionica Baylahuen H. B.—Description.—A perennial plant, belonging to the Order of Compositæ-Synantherеæ, indigenous to Chili, a neighbor of Grindelia robusta, and remarkable for the resinous exudation with which all its parts are covered. The dried plant appears as if steeped in a resin bath.

Composition.—Besides this resin which, when isolated, is

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brown, odorous, and acrid, the plant contains an essential oil, but has not responded to alkaloidal reagents.

Therapeutical Properties.—In Chili it is employed in certain gastro-intestinal affections. Baillé accords to it very marked antidiarrhœic properties, and Cervello, of Valparaiso, has used it with good results in acute and chronic dysentery and the rebellious diarrhœa of phthisis. The large quantity of aromatic resin which it contains constitutes it a balsamic which may find a place in the treatment of pulmonary affections and diseases of the urinary passages.

Use and Doses.—Baillé recommends the aqueous infusion (1:150), rather than the alcoholic tincture which does not seem to act in the same manner and—an important point—does not cause constipation.

Ichthyol.—Preparation.—The substance from which it is prepared is the product of distillation of the bituminous rocks of Tyrol which contain fossil fishes. This substance, which contains some sulphur, is treated with concentrated sulphuric acid and then neutralized with carbonate of sodium.

Description.—The product, as sold, is properly speaking a salt, containing sulphichthyolic acid combined with an alkali. It has the appearance of tar, a feebly alkaline reaction, and the consistence of vaselin. It is soluble in water, also in a mixture of alcohol and ether; it mixes in all proportions with fats and oils. An ammoniacal salt is likewise prepared.

Composition.—According to the analyses of Baumann and Schotten, the sodium salt, dried over sulphuric acid, has the following composition: $C_{56}H_{86}S_6Na_4O_{12}$. It is, then, the salt of a sulphur compound, analogous, for example, to the phenol-sulphuric acids. The sulphur which it contains in large proportions comes partly from the original product and partly from the sulphuric acid. The sulphonization renders the sulphuretted oil soluble in water, and this makes ichthyol a very different compound from the sulphuretted organic combinations hitherto in use.

Therapeutical Properties.—Introduced into therapeutics by Unna in 1883, ichthyol has become a remedy largely used in Germany and elsewhere.

Unna has employed it in skin diseases, rheumatism, and psoriasis; but it is chiefly recommended for eczema. It has

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the advantage that it causes no dermatitis which would be inevitable under the use of an ointment containing 10% of sulphur.

Zugler considers ichthyol as a saving remedy which succeeds in cases of catarrh of the bladder, chronic discharges, nephritis, and diabetes.

Dr. Felix, surgeon to the hospitals of Brussels, praises the good effects in anthrax of the following medication: thrice a day he applies to the tumor a thick layer of this ointment:

Ichthyol, ...	gr. xlv.
Camphorated cerate, ...	℥ ss.

He covers the whole with antiseptic cotton, and on the following day introduces into all the small white points of suppuration the tip of a pencil of silver nitrate. The ichthyol rapidly lessens the inflammation and pain, favors the elimination of the core, and hastens cicatrization.

Use.—Externally as an ointment made with vaselin or lanolin. Aqueous and ether-alcohol solution. The dose varies from 0.5 and 1% (excoriations in children) to 50%. For internal use, it is convenient to use the sodium or ammonium salt which are purer products than ichthyol. The lithium and zinc salts are less employed. Internally, pills of gr. iss. (one to four pills, three times a day). Capsules. Aqueous solution, rarely employed on account of its disagreeable taste.

Iodide of Methyl.—Synonym: Methyliodohydric ether. Formula, C_2H_3I.

Preparation.—One part of phosphorus, eight parts of iodine, and fifteen parts of methylic alcohol are distilled. The distillate is washed with water, and then rectified.

Description.—A colorless liquid, whose odor is not disagreeable; boils at 109.4° F.

Therapeutical Properties.—Vesicant.

Use.—For local application.

Iodol.—Synonym: Tetra-iodo-pyrrol. Formula, C_8HI_4N.

Preparation.—Pyrrol—which is derived from the distillation of Dippel's (animal) oil, the part coming over about 266° F. being collected—is dissolved in alkaline water to which is added a solution of iodine in iodide of potassium; a precipitate forms which is washed with alcohol.

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Description.—An amorphous, brown, odorless powder; contains 80% of iodine; decomposes between 284 and 302° F.

Therapeutical Properties.—Powerful antiseptic and local anæsthetic.

Use and Doses.—Internally, gr. iss. per day. Externally, the powder as a local application. Solution in alcohol, ether, or oil.

Ipeuva.—Synonym: Tecoma speciosa D. C.

Description.—A plant belonging to the Order of Bignoniaceæ, indigenous to Brazil.

Therapeutical Properties.—Bitter, diuretic, and blood purifier, having an agreeably bitter taste. It is given in syphilis and rheumatism.

Use and Doses.—Powdered leaves, ʒ ss. in O ij. of water for infusion. Fluid extract, ʒ ss.–i.

Iris versicolor L.—Description.—A plant belonging to the Order of Iridaceæ, indigenous to North America.

Composition.—The tincture, precipitated with water, furnishes a substance called iridin (oleoresin).

Part Employed.—The root.

Therapeutical Properties.—Cathartic, alterative, and cholagogue. The oleoresin is emetic and diuretic.

Use and Doses.—Powdered root, gr. iv.–xxx. Iridin, gr. ¼ to iss., in pills given at night.

Isatropylcocaine.—Formula, $C_{19}H_{22}NO_4$.

Description.—An amorphous alkaloid of coca which may be the cause of the toxic symptoms that sometimes follow the administration of cocaine.

Isolated by Liebermann who found it to constitute 70% of the amorphous alkaloidal products which form the residue of the operation. Soluble in alcohol, ether, benzin, chloroform; slightly soluble in petroleum ether.

Hesse has demonstrated that in this alkaloid the radical of benzoic acid which exists in cocaine is replaced by an isomer of isatropic acid.

Purification.—Cocaine should be treated with petroleum ether which dissolves it and leaves behind the impurities, among others isatropylcocaine.

Physiological Properties.—According to Liebreich, it is a

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cardiac poison which gives rise to the accidents that have been observed with impure cocaine. It has no effect on the sensibility and is void of anæsthetic properties.

Jacaranda Caroba.—Synonyms: Caroba, Jacaranda procera, Jacaranda tomentosa, Cybistax antisyphilitica.

Description.—A plant belonging to the Order of Bignoniaceæ, indigenous to Brazil and Colombia.

Composition.—A crystalline alkaloid, carobine, has been found, and a balsamic resin, carobone.

Therapeutical Properties.—The drug is recommended as an antisyphilitic and may be combined with the iodides. It is also employed in chronic blennorrhagia and in various venereal, cutaneous, and rheumatic affections: chancres, buboes, ulcers, impetigo, psoriasis, articular pains, nervous headache, chronic catarrh of the urethra, osteocopic pains, and chronic neuralgias.

Use and Doses.—Caroba leaves in infusion, ℥ iv. of the leaves in O ij., in doses of one teaspoonful, three times a day. Fluid extract, ♏ xvi. to ʒ i., three times a day.

Jacaranda lancifoliata.—Description.—A plant belonging to the Order of Bignoniaceæ, indigenous to Brazil.

Part Employed.—The leaves.

Therapeutical Properties.—Employed in purulent catarrhs of the genito-urinary organs without giving rise to any untoward effects. It greatly lessens the pain and arrests the discharge of blennorrhagia; where the discharge persists, the fluid extract is used by injection, with good results.

Use and Doses.—Internally, fluid extract, gtt. xx.–xxx. per day. For injection, gtt. x. of the fluid extract in fl. ℥ i. of water.

Jatropha Curcas L.—Synonym: Barbadoes nut tree; physic nut.

Description.—A plant belonging to the Order of Euphorbiaceæ, indigenous to Central and South America, India, and western Africa.

Therapeutical Properties.—From the seeds an oil is expressed which constitutes an energetic purgative, less violent than croton oil, but more active than castor oil; it is free from the disagreeable taste of the latter and resembles that of oil of sweet almonds.

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Use.—Gelatin capsules containing gtt. v.

A tincture of the seeds has been proposed, to take the place of the oil.

Doses.—A purge of gtt. xij.–xv. of jatropha oil corresponds to one produced by fl. ʒ i. of castor oil.

Juglans cinerea.—Synonym: Butter-nut.

Description.—A plant belonging to the Order of Juglandaceæ.

Part Employed.—The inner bark, especially that of the root which is the most active portion.

Therapeutical Properties.—This drug overcomes habitual constipation, and particularly dysentery; the purgation it produces is gentle and causes neither griping nor subsequent irritation. Combined with calomel it has been used in intermittent fevers or in affections complicated with congestion of the abdominal viscera.

Use and Doses.—Decoction. Resinous extract (juglandin) as a substitute for rhubarb, gr. xv.–xxx. as a purgative, gr. ivss.–x. as a laxative. Fluid extract, fl. ʒ i.–ij. Tincture (1:5), as a cathartic, in doses of fl. ʒ i.–ij.

Jurubeba.—Synonym: Solanum paniculatum L.

Description.—A shrub belonging to the Order of Solanaceæ, indigenous to Brazil.

Part Employed.—The leaves or the juice of the fresh leaves.

Composition.—Contains a mucilage and a bitter principle.

Therapeutical Properties.—Alterative, tonic, diuretic, hydragogue, and drastic.

Used in intermittent fevers, jaundice, gonorrhœa, and syphilis. As a purgative in affections of the liver and hypochondria.

Use.—As an application to ulcers and wounds.

Doses.—Fluid extract, gtt. i.–v., four times a day. Infusion of the leaves, gr. xxx. in O i. of water.

Justicia Adhatoda L.—Description.—A plant belonging to the Order of Acanthaceæ, indigenous to Malay.

Therapeutical Properties.—Useful in bronchitis, asthma, and fevers. The leaves may be smoked in asthma.

Use and Doses.—Powdered leaves, gr. viij., three times a day. Tincture (1:5), ʒ ss.–i.

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Justicia Gendarussa L.—Synonym: Gendarussa vulgaris Nees.

Description.—A shrub belonging to the Order of Acanthaceæ, very common in India.

Therapeutical Properties.—The leaves, after being slightly roasted, are used in India as a decoction for chronic rheumatism with swelling of the joints (Ainslie). Emetic properties are also attributed to them.

Kairine.—Synonyms: Methylhydride of oxyquinoline, oxyhydromethylquinoline. Formula, $C_{20}H_{13}NO_2$.

Preparation.—Oxyhydroquinoline, a body derived from quinoline, is treated with methylhydriodic ether.

The salt used is the hydrochlorate of kairine.

Description.—Small yellowish-white crystals, having a faint odor of musk and a bitter taste. Soluble in water and alcohol, insoluble in ether and glycerin.

Imparts a dark green color to the urine; gives a yellow color with nitric acid; is colored red by chlorine water; gives a yellow precipitate with picric acid. Ammonia precipitates it from its aqueous solution.

Therapeutical Properties.—Being, like quinine, a derivative of quinoline, it has been used as a substitute for quinine (antiperiodic and antithermic). Kairine is more of an antipyretic, but its action is not sure. Besides it alters the blood by destroying the hæmoglobin.

Use and Doses.—In wafers containing gr. viij., one to three at a dose, until the temperature is reduced to the normal.

Kaladana.—Synonyms: Pharbitis Nil, Choisy.

Description.—A plant belonging to the Order of Convolvulaceæ indigenous to India.

Part Employed.—The seeds.

Composition.—Contains a resin, pharbitisin (identical with convolvulin).

Therapeutical Properties.—An efficacious cathartic, free from inconveniences, having the properties of jalap, but less active.

Use and Doses.—Powdered seeds, in doses of ʒ ss. to ʒ ij. Resin, in doses of gr. ivss.–viij.

Kamala.—Synonym: Rottlera tinctoria Roxb.

Description.—A plant belonging to the Order of Euphor-

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biaceæ, indigenous to India, Arabia, Australia, Abyssinia, and the Sunda islands.

Part Employed.—The resin of the pollen.

Composition.—Anderson has extracted a resin with ether, rottlerin, $C_{11}H_{10}O_3$, which crystallizes in ether. Gerkin has isolated another crystalline body, mallotonin, $C_{14}H_{10}O_3$. With potassa fusa these resins furnish paraoxybenzoic acid.

Therapeutical Properties.—Tænifuge, given for bothriocephalus. Locally in herpes circinatus and leprosy.

Use and Doses.—In wafers or plain, in doses of ʒ iss. to ℥ ss. (gr. xv.–xxx. at a dose), for adults, and ʒ ss. for children. Tincture (1:5), fl. ℥ ss.

Compound syrup (Davaine):

Tincture of kamala, ...	ʒ v.
Mint water, ...	fl. ℥ iv.
Syrup of bitter orange peel, . . .	fl. ʒ vi.

To be taken in six doses.

Kava.—Synonym: Piper methysticum Forst.

Description.—A plant belonging to the Order of Piperaceæ, indigenous to the islands of Oceanica.

Part Employed.—The root.

Composition.—Gobley has succeeded in isolating two crystallizable substances, kavain and jankonin, and two resins.

Therapeutical Properties.—Stimulant tonic, successfully used in gonorrhœa and mucous fluxes. The sedative action of kava in acute blennorrhagia is probably due to its anæsthetic properties. To the same property must be attributed the success attained with it by Chéron in the treatment of cystitis of the neck of the bladder which occurs in women suffering from uterine affections.

It is diuretic and sudorific.

According to Lewin, the resin extracted from the roots is as powerful an anæsthetic as cocaine.

It serves for the preparation of an intoxicating drink much used by the natives.

Use and Doses.—Mixture:

Fluid extract of kava, ...	fl. ʒ v.
Glycerin, ...	fl. ℥ iss.

A teaspoonful to be taken in a glass of water after every meal.

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The fluid extract is prepared from the root in moderately fine powder with 90% alcohol, given in doses of ♏ xvi.–xlviij. Soft extract, gr. xv.–xxx., in pills.

Kaya senegalensis Suss.—Synonyms: Cailcedra, Swietenia senegalensis Desr., Senegal cinchona.

Description.—A tree belonging to the Order of Meliaceæ.

Part Employed.—The bark.

Composition.—Contains an alkaloid, cailcedrine (Caventou).

Therapeutical Properties.—Febrifuge and tonic, like cinchona.

Use.—Tincture (1:5), ʒ i. per day.

Kola.—Synonym: Sterculia acuminata P. Beauv.

Description.—A tree belonging to the Order of Malvaceæ, indigenous to central Africa.

Part Employed.—The fruit, called kola nut.

Composition.—This seed has been studied botanically and chemically by Heckel and Schlagdenhauffen, who have found tannin, 2.4% of caffeine, and theobromine. It was introduced into France by Natton.

Therapeutical Properties.—It is a food substitute, like tea and coffee, used by the African negroes as a tonic masticatory, as the Peruvian Indians chew coca.

Kola nuts have been studied from a therapeutical standpoint by Dujardin-Beaumetz, Huchard, and Monnet. The drug acts on the heart as a powerful tonic, regulates the pulse, but is a feeble diuretic. It is also an antidiarrhœic and a powerful nervous stimulant used in fatigue and indigestion.

Use and Doses.—Dujardin-Beaumetz has tried the different preparations made by Natton and indicates the formulæ. Tincture, 1:5. Wine. Syrup. Hydro-alcoholic extract. Elixir of kola. Powdered kola. Tea-like infusion (Société de Thérapeutique).

Doses.—Wine, fl. ʒ ij.–iij. per day. Elixir, four teaspoonfuls per day. Powder, gr. viij.–xxiv. Fluid extract, gtt. x.–xxx. Soft extract, gr. ij.–viij. Tincture, fl. ʒ iiss.

Koumys.—Preparation.—A fermented liquor, prepared in Siberia and Tartary from sour mare's milk.

In France, two parts of ass' milk are mixed with one part of cow's milk and made to ferment by means of the Saccha-

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romyces cerevisiæ. [In the United States, cow's milk alone is generally used.]

Description.—A whitish liquid of a sour taste.

Therapeutical Properties.—Used as a strengthening, antiscrofular, and antiscorbutic remedy, principally in the treatment of phthisis.

Use and Doses.—Two tumblerfuls to be taken between meals. The dose is increased to two tumblerfuls in the morning and two in the afternoon, but they should not be taken immediately before or after meals.

Kowri Resin.—Description.—This resin comes from a conifer of the Dammara tribe, indigenous to New Zealand and New Caledonia. It is used in the preparation of varnishes and appears in two forms—a fossil kind which is of the higher commercial value; the other is gathered from the trees, is soluble in 90% alcohol, ether, and with difficulty in spirit of turpentine.

Composition.—Its chemistry has been studied by Thomson in England, Dulk in Germany, and H. Bocquillon in France.

By dry distillation they obtained an ethereal oil called by dammarol by Thomson and dammarylene by Bocquillon. The residue contains an acid resin, dammaric acid, which forms transparent crystalline salts, and a neutral resin, the dammaryle of Dulk.

Therapeutical Properties.—Recommended by Fornet in cutaneous affections to take the place of collodion and traumaticin.

Internally it acts favorably in vesical catarrh.

The syrupy alcoholic solution which has an agreeable odor may take the place of collodion in the dressing of wounds and has also been used instead of tincture of benzoin in the treatment of carious teeth.

The solution of this resin in its volatile part can be used for histological preparations, like Canada balsam.

Lachnanthes tinctoria Ell.—Synonym: Red root.

Description.—A plant belonging to the Order of Hæmodoraceæ, indigenous to North America.

Part Employed.—The root.

Therapeutical Properties.—Used in pneumonia, typhoid fever, cerebral affections, laryngitis, hoarseness, as a general

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nervous and pulmonary sedative. It greatly alleviates the cough of phthisis.

Use and Doses.—Tincture of the root (1 : 10), ʒ i.

Lactate of Quinine.—Commercial lactate of quinine does not answer the requirements of the Codex as to solubility (soluble in three parts of water); it dissolves with difficulty in six parts of water. This relative insolubility has caused its hypodermic use to be abandoned.

Preparation.—By some ingenious manipulation P. Vigier has prepared a 1 : 5 solution which keeps well and will permit the resumption of its hypodermic use. This is Vigier's formula:

Sulphate of quinine, ...	ʒ vss.
Distilled water, ...	fl. ʒ xiij.
Sulphuric acid, 10% dilution, . . .	fl. ʒ viss.

Dissolve and precipitate by an excess of ammonia, about ʒ vi., and filter; wash the precipitate with distilled water and introduce it into a tared capsule with about ♁ iv. of lactic acid; add fl. oz. 3¼ of warm distilled water (about 176° F.), in order to render the liquid transparent and render it neutral; evaporate on a water bath until reduced to about fl. oz. iij. and let it cool; filter from the separated crystals and preserve the filtrate in a bottle with paraffined stopper.

Doses.—♁ iv. of this solution contain gr. xv. of lactate of quinine, calculated according to the chemical equivalents; hence each syringeful contains gr. iij. of the neutral quinine salt.

Lactic Acid.—Therapeutical Properties.—A destructive agent for pathogenic tissues; it destroys fungous granulations and transforms them into a blackish mass. This observation suggested to Mosetig the idea of studying its action on neoplasms and on lupus vulgaris. Repeated applications led to recovery and complete cicatrization; all the pathological tissue with its vessels was destroyed, but the islets of sound tissue remained intact.

Use.—In a liquid and concentrated state it may be frequently painted on the parts. In order to protect neighboring portions from the action of the remedy, the circumference of the wound may be covered with an adhesive plaster or with a coating of grease.

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The best procedure consists in employing it in the form of wadding or linen saturated with the acid. Above it a piece of oiled silk is placed, and the whole fixed with a bandage. The acid is left in place for twelve hours, when the wound is carefully washed. In order to avoid dermatitis and œdema, twenty-four or forty-eight hours should intervene between the applications. The pain lasts only a few hours and is bearable. The cicatrix is soft and pliable.

Doses.—For internal use, gtt. xv.–xx. in a spoonful of water.

Lamium album L.—Synonym: White nettle.

Description.—A plant belonging to the Order of Labiatæ, indigenous to Europe.

Parts Employed.—The flowers and roots.

Therapeutical Properties.—Successfully used in pulmonary and bronchial hemorrhages, hæmoptysis, and metrorrhagia.

Use and Doses.—Infusion (℥ i. in O ij. of water), fl. ℥ ij., every two hours. Tincture (1:5):

Tincture from the flowers, . . .	fl. ℥ vi.
Simple syrup, ...	fl. ℥ iss.
Distilled water, ...	fl. ℥ x.

Half a teaspoonful every two hours; after the symptoms have ameliorated, a tablespoonful every four hours.

Lanolin.—Description.—Chemically, it is a cholesteric ether, derived from keratinized substances.

Preparation.—It is extracted from wool fat which contains a large percentage.

Test.—Red litmus paper should not turn blue when placed over a flask containing gr. iss.–iij. of lanolin with fl. ʒ iiss. of a 30% caustic soda solution, under the application of heat; pure lanolin, heated in a capsule with six times its weight of distilled water, melts, floats on the surface of the water, and remains clear while cooling; under the same conditions impure lanolin becomes spongy. Lanolin should not yield glycerin to the water with which it is heated. When lanolin is kneaded with water under exclusion of the air, it takes up much more than its own weight of water without becoming soapy to the touch, and when triturated in a mortar, it does not separate from the pestle or from the spatula.

Therapeutical Properties.—This substance has found a

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novel therapeutical application owing to its property of taking up water and to the great facility of absorption of ointments having a lanolin base. Being neutral, not liable to become rancid, and having the consistence of lard, it is a suitable vehicle for ointments. It absorbs twice its weight of glycerin, and its own weight of water. Hence it will serve for incorporating into an ointment a solution of a salt, an extract, an alkaloid, a soluble antiseptic, etc.; moreover, such preparations keep for a long time.

Lanolin also possesses the property of extinguishing mercury and directly forms mercurial ointments.

Lantana brasiliensis Link.—Synonym: Yerba sagrada.

Description.—A plant belonging to the Order of Verbenaceæ, indigenous to Brazil.

Composition.—Contains lantanine, an alkaloid discovered by Buiza and Neyreta, of Lima.

Therapeutical Properties.—The alkaloid acts on the circulation and lowers the temperature. It is well borne by weak stomachs. Gr. xxx., administered immediately after an attack, cure intermittent fever where quinine fails.

Use and Doses.—Gr. xv.-xxx. in pills of gr. iss., every twenty-four hours. The tincture is so bitter that it is not practicable to prescribe it.

Lawsonia inermis L.—Synonym: Lawsonia alba.

Description.—A shrub belonging to the Order of Lythraceæ, very common in the Orient. The leaves are small, oval, and coriaceous.

Preparation.—The coloring principle is extracted by means of boiling water.

Therapeutical Properties.—The leaves, powdered and reduced to a paste with oil, are used in cataplasms for headache and migraine. The fluid extract is also used in lepra. The decoction is recommended in jaundice, hepatitis, calculous affections, and diseases of the spinal cord.

From time immemorial the leaves have been used, under the name of henna, by Oriental women for staining the palms and nails of the hand an orange red.

Use and Doses.—Fluid extract, fl. 3 v., twice a day.

Legumin.—Preparation.—As the flour of the leguminosæ contains little if any starch, the seeds are decorticated, passed

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through a mill, and the fixed oil having been extracted by means of bisulphide of carbon, are made into bread or biscuits.

Therapeutical Properties.—Used for alimentation in diabetes, under different forms.

Leonotis nepetæfolia.—Synonym: Rascamone.

Description.—A plant belonging to the Order of Labiatæ, indigenous to Africa, Brazil, etc.

Part Employed.—The leaves.

Therapeutical Properties.—Tonic, antispasmodic, very efficacious in the typhoid fever prevailing in tropical regions. The natives use it in intermittent fevers, mixed with lemon juice and rum.

Use and Doses.—Tincture (1:5), in doses of ʒ ij.

Leptandra virginica.—Synonym: Veronica virginica L.

Description.—A plant belonging to the Order of Scrophulariaceæ, indigenous to North America.

Part Employed.—The rhizome.

Composition.—Contains a resinous principle.

Therapeutical Properties.—The fresh rhizome is emetocathartic. Desiccated, it is said to be tonic, cholagogue, and laxative; it has been used in affections of the liver, typhoid fever, dyspepsia, diarrhœa, dysentery, and cholera infantum.

Use and Doses.—Powder, ʒ ss.–i. Fluid extract, ♏ xvi.–xlviij. Decoction of the root, ʒ ss.–i. Leptandrin (the "resin"), gr. ⅛ to ¼.

Liatris odoratissima Willd.—Synonyms: Deer's tongue, hound's tongue.

Description.—A plant belonging to the Order of Compositæ-Synantheræ, indigenous to Carolina and Florida.

Part Employed.—The leaves.

Composition.—The leaves contain coumarin.

Therapeutical Properties.—The leaves are aromatic, stimulant, and diaphoretic; dried, they are used to preserve clothes from insects.

Ligusticum apiifolium.—Synonym: Lovage.

Description.—A plant belonging to the Order of Umbelliferæ which is held in high esteem by the North American Indians.

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Therapeutical Properties.—The powdered root is used in the forms of cataplasms in sprains. In a tea-like infusion it is a remedy for cramps of the stomach.

The Indians stuff their nostrils with fragments of the bark to guard against epidemics.

Lipanin.—Preparation.—From 5 to 6% of oleic acid are added to fine olive oil.

Therapeutical Properties.—Recommended by Mering as a substitute for cod-liver oil. It has an agreeable taste, is readily emulsified, and is absorbed with great facility. It is better borne than cod-liver oil and never causes diarrhœa as the other fixed oils do. It possesses a high nutritive value and constitutes a good aliment which is very useful in affections of the urinary passages.

Doses.—A small liqueur-glassful before every meal.

Lippia mexicana Rich.—Description.—A plant belonging to the Order of Verbenaceæ, indigenous to Mexico. It has been studied by Podwissotzki, of Dorpat.

Composition.—Contains a camphor, lippiol, which seems to be the active principle of the plant.

Therapeutical Properties.—Recommended for asthma and the cough of phthisis.

Use.—The best preparation is a tincture made from the fresh plant with alcohol sufficiently concentrated to dissolve both the camphor and the essence. The proportions are, one part by weight of the flowers and leaves to nine parts of alcohol.

Lodoicea Sechellarum Lab.—Synonyms: Jahari, cocoa tree of the Seychelles.

Description.—A tree belonging to the Order of Palmaceæ, growing solely in the Seychelles islands.

Therapeutical Properties.—Tonic, febrifuge, and antidote.

Use and Doses.—Fluid extract, in doses of gtt. ij.–v.

Lucuma Cainito D. C.—Synonym: Abiaba.

Description.—A plant belonging to the Order of Sapotaceæ, indigenous to Brazil.

Composition.—Contains lucumine.

Therapeutical Properties.—Powerful tonic, antidiarrhœic, antidysenteric, antiperiodic, employed in intermittent fevers.

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Doses.—As an antidiarrhœic, gr. iss.–ij.; as an antiperiodic, gr. iij.–viij.

Lucuma glycyphlœum Casar.—Synonym: Monesia Guaranhem.

Description.—A plant belonging to the Order of Sapotaceæ, indigenous to the Antilles.

Therapeutical Properties.—Tonic and astringent, used in affections of the lungs, diseases of the bladder, diarrhœa, and blennorrhagia. It acts on the uterus like ergot.

Use and Doses.—Decoction, ʒ i. in O i. Extract, gr. iij.–xxx.

Lucuma mammosum Gaert.—Synonym: Marmalade tree.

Part Employed.—The seeds.

Therapeutical Properties.—Useful in nephritic colic.

Use and Doses.—Powder, in doses of gr. iij., in wafers or pills.

Lycopodium clavatum L.—Description.—A plant belonging to the Order of Lycopodiaceæ, indigenous to Europe.

Therapeutical Properties.—Possesses a specific action on the liver and the urinary organs; is effectual in the spasmodic retention of urine in children, and in the vesical catarrh of adults; laxative and carminative; employed also in infantile enteritis and passive pulmonary congestion. Externally, it is remarkably effective in cutaneous eruptions, erythema and acne.

Use and Doses.—Internally, tincture (1:5), in doses of gtt. x.–lx., two or three times a day.

Lycopodium Saururus Lamk.—Description.—A plant growing throughout South America.

Therapeutical Properties.—It is employed in gastric catarrh, but must be used with care, as it is emetic in large doses. The resin of the plant is purgative. The alkaloid, piligaline [?], is toxic, emetic, and convulsant (Bardet).

Lycopus virginicus L.—Synonym: Called charmweed by the Indians.

Description.—A plant belonging to the Order of Labiatæ, indigenous to the United States.

Therapeutical Properties.—According to K. Briggs, it possesses a special power in the case of stings and bites of insects

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and venomous reptiles. The Indians bruise the plant and swallow the juice. Briggs has used it, in a patient who had been dangerously bitten, in the form of a decoction of ʒ v. in a pint of water, partly on compresses applied to the wound, partly internally; the patient was cured the third day.

It gives good results in hæmoptysis and the first stages of phthisis.

It is said to be astringent, sedative, and even narcotic.

Use and Doses.—Infusion (℥ x. in O i. of boiling water), to be taken in divided doses during the day.

Mammea americana L.—Description.—A plant belonging to the Order of Guttiferæ, indigenous to the Antilles and to tropical America.

Therapeutical Properties.—The water distilled from the flowers is refreshing and digestive. The gum-resin is antiparasitic and used against the chigo. The decoction of the bark is emollient and is applied locally to wounds and injuries. The seeds are bitter. A decoction of the leaves is recommended for intermittent fevers.

Mandragora.—Synonym: Atropa Mandragora L.

Description.—A plant belonging to the Order of Solanaceæ, indigenous to Europe.

Composition.—Contains mandragorine which, according to some authors, is the same as atropine; but, according to Crouzel and Richardson, it is a special alkaloid.

Therapeutical Properties.—The bark of the root is emetic. The leaves and the root are used in maniacal insanity as narcotics and sedatives.

Mangifera indica L.—Synonyms: Mango, mango tree.

Description.—A tree belonging to the Order of Anacardiaceæ, indigenous to all tropical countries.

Parts Employed.—The fruit, and the bark from which a fluid extract is prepared.

Therapeutical Properties.—An efficacious astringent. It is given in fevers, metrorrhagia, leucorrhœa, scabies, and cutaneous affections. The resinous sap is antidysenteric.

Use and Doses.—Fluid extract, fl. ʒ iiss.; water, fl. ℥ iv., as a gargle. Internally, a teaspoonful every two hours.

Meconarceine.—Synonym: Meconate of narceine.

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A combination of narceine with meconic acid, proposed by Laborde.

Preparation.—Meconic acid and narceine in equivalent proportions are mixed by trituration. On solution, this powder forms meconarceine. Theoretically it is preferable to combine meconic acid (the acid of opium) with the opium alkaloids, rather than any other acid. Moreover, in England the salts of meconate of morphine are used for hypodermic injection.

Description.—A white powder, fusing at 230° F., soluble in boiling water and in weak alcohol, slightly soluble in strong alcohol.

As meconic acid is a bibasic acid, it forms in reality two salts; one, the mono-meconate, crystallizes in yellow needles, while the bi-meconate crystallizes in white needles.

Therapeutical Properties.—Sedative, calmative, and hypnotic; used in neuralgia and rheumatic affections.

Use and Doses.—In sterilized hypodermic solutions. In pills, containing gr. $\frac{1}{10}$ to $\frac{1}{3}$.

Medicated Gelatin Tablets.—Preparation.—Swedish Process: As employed by Almen, professor at Upsala, it consists in dissolving or suspending the medicaments in the gelatin. This gelatin is spread in a thin layer on a mould of tinned iron, whose surface is divided into small squares corresponding to the dose it is desired to obtain. The dried film, when removed from the mould, retains the impression of the divisions of the mould, so that the squares can be easily divided with scissors. According to the directions of the physician, the patient places one, two, or three of these into a spoon with a little water, and swallows them when they are softened.

The salts of arsenic, morphine, and in short all the drugs which are prescribed in small doses, are easily prepared and administered in this way.

A Venetian pharmacist, Pietro de Cian, has brought together into a small portfolio all the drugs thus prepared. Each gelatin leaf, containing fifty or sixty divisions, is inclosed in an envelope on which are printed the name, the dose, and the mode of administration of the medicament.

Limousin's Process: As an improvement on Almen's process, Limousin employs a mould of silvered copper divided into sixty small squares, the sides of which measure two-fifths of

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an inch. The dividing lines are sunk into the bottom of the mould, and have their counterparts in prominent lines on the cover of the mould. The gelatin, liquefied on a water bath, is poured on the slightly warmed lower plate; then the cover is applied, taking care to interpose two small metal bands in order to give the gelatin leaf a uniform thickness throughout. The whole is placed in a press, and in a few minutes the cooled mould is withdrawn. The portions beyond the sixty divisions are cut away, and the leaf is weighed.

The weight being known, nothing is easier than to calculate the proportions of the drug to be introduced. If the six divisions weigh ℈ iv. or ʒ iss. and it is intended to incorporate $\frac{1}{60}$ grain of the drug for each division, one grain of the medicament is added, or as many times the quantity as there are squares to be charged, and the whole is then evaporated to the original weight.

If the drug is insoluble, it is preferable to suspend it in a thick solution of gum acacia before it is intimately mixed with the melted gelatin.

In this way the drug is more accurately divided than in the manufacture of pills or granules.

Moreover, the drugs keep infinitely, and occupy less volume than the alkaloidal solutions. They may be used to supply a colony or an army in the field.

The principal drugs used in this form are: arseniate of sodium, gr. $\frac{1}{15}$; laudanum, gr. iss.; sulphate of quinine, gr. $\frac{3}{4}$ and gr. iss.; ipecac, gr. $\frac{3}{4}$; lactate of iron, gr. $\frac{3}{4}$; opium, gr. $\frac{3}{4}$; extract of colocynth, gr. $\frac{3}{4}$; extract of aconite, gr. $\frac{1}{20}$; extract of belladonna, gr. $\frac{1}{30}$; salicylic acid, gr. iss.

Medicated Gelatin Tablets in Ophthalmology.—Lepердriel has prepared dry collyria with atropine or morphine, suspended in gelatin wafers.

Vée and Duquesnel employ this method to subdivide and administer eserine or physostigmine.

Medicated Soaps.—Preparation.—Animal soap is grated and the drug required is incorporated by pounding in a mortar. After fusion on a water bath under agitation it is cast into moulds.

Thymol soap.—Contains one part of thymol in a thousand. Used in minor skin diseases of the face.

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Petroleum soap.—Contains from 50% to 60% of refined petroleum. (The soap possesses the property of solidifying the petroleum.) Constantin Paul recommends it for scabies.

Ichthyol soap.—Contains from 20% to 50% of ichthyol. Used in eczema, prurigo, and herpes.

Menthol.—Description.—The concrete portion of the oil of peppermint produced by the varieties Mentha piperita, crispa, hirsuta, and canadensis. According to Beckmann and contrary to the opinion of chemists who have studied Japanese oil of peppermint, the liquid portion separated from menthol is neither menthene ($C_{10}H_{16}$) nor an isomer of menthol ($C_{10}H_{20}O$). This liquid, whose composition may be represented by the formula $C_{10}H_{18}O$, is isomeric with menthone, a compound obtained by Morrigan and Atkinson by the oxidation of menthol.

The liquid portion of Japanese oil of peppermint is, therefore, a simple solution of menthol in menthone and the former constitutes more than two-fifths—a quantity not to be disregarded in view of the commercial value of menthol.

The similarity of the boiling points of the two bodies (menthol 411.8°, menthone 402.8° F.) renders their separation impracticable by ordinary means. Experiments were instituted with a view to convert menthone into menthol. First Beckmann demonstrated that by the action of hydroxylamine, menthone is converted into oximidomenthone, a compound soluble in dilute sulphuric acid, which furnishes one means of separation. But other experiments have proved that menthone in ethereal solution, with the addition of the theoretical quantity necessary for the transformation, is converted, in the cold, into menthol. This discovery is of great practical importance, since menthone is the principle which imparts to essence of mint an acrid taste and a disagreeable odor, and its reduction to menthol will materially improve inferior essences.

By the same chemical process the ordinary Laurus camphor is transformed into borneol.

Tests and Reactions.—Menthol dissolves easily in twice its weight of chloroform. A small quantity of iodine suffices to produce (slowly) a beautiful indigo color. This color disappears on the addition of caustic soda or potassa. Concentrated sulphuric acid produces in the cold a faint black color. Solution of caustic potassa does not react upon menthol.

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To demonstrate the presence of thymol in menthol pencils, one part of the menthol is added to four parts of concentrated sulphuric acid. If the mixture contains thymol it becomes yellow which changes to red under the application of heat. If to the latter liquid ten parts of water are added and the mixture is digested with an excess of carbonate of lead, and to the filtered liquid a trace of perchloride of iron is added, a violet color appears. Menthol dissolved in chloroform or alcohol is colored reddish-violet by a solution of caustic potassa if it contains thymol.

Bacteriological Properties.—It is one of the best antiseptics known.

Therapeutical Properties.—A powerful antineuralgic which is almost unfailing in migraine, neuralgias, sciatica, and toothache; it is also useful in humid asthma and catarrh of the respiratory passages.

Menthol is also employed in cutaneous affections, eczema, herpes, etc. It also arrests vomiting.

In order to be absorbed by the skin, menthol must be perfectly pure and melt at 195.8° F.

Use.—Local applications in the shape of pencils. Inhalations, through the mouth or nose, of the vapors disengaged from menthol crystals.

Methacetin.—Synonym: Para-acetanisidin. Formula, $C_4H_6.OCH_3.NH.C_2H_3O$.

Description.—A crystalline, odorless, slightly reddish powder, of a saline bitter taste; soluble in water and alcohol, both hot and cold; in acids and in alkalies; melts at 248° F.

Physiological Properties.—A powerful antiseptic; a 1% solution arrests the decomposition of milk and ammoniacal fermentation. In somewhat large doses it is toxic, with symptoms analogous to those caused by antipyrine.

Therapeutical Properties.—Antipyretic, according to the experiments of Prof. von Jaksch, of Gratz. The lowering of the temperature which it produces in fevers is remarkable.

Doses.—Caution should be exercised in the matter of doses and their effect should be watched; generally gr. ij.–iij. are given, but gr. iv. should not be exceeded.

Methylal.—Synonym: Dimethylate of methylene. Formula, $CH_2.OCH_3.OCH_3$.

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Preparation.—A mixture of methylic alcohol, sulphuric acid, and peroxide of manganese is distilled; a mixture of formiate of methyl and methylal passes over. By agitating this product with caustic potassa the formiate of methyl is destroyed without attacking the methylal. Prepared by Malaguti in 1839.

Description.—A limpid, very mobile liquid which slightly reddens litmus paper; it dissolves in three times its volume of water, in alcohol and ether, in fixed and volatile oils; its vapors are not inflammable; its odor recalls that of chloroform and acetic ether. It boils at 107.6° F. and its sp. gr. is 0.8551.

Therapeutical Properties.—Used for nervous, gastric, and intestinal pains. It is an excellent anæsthetic in the form of an ointment or liniment. Its high price is a bar to its more general use.

Krafft-Ebing, of Gratz, has administered it by hypodermic injection and has sometimes secured sleep by it at the end of two hours. If one dose does not suffice, it is repeated at some convenient interval, in order to secure profound and wholesome slumber, which sometimes lasts twenty hours. According to this author, it is the most quieting hypnotic in delirium tremens. Krafft-Ebing thinks its use is indicated in insomnia due to inanition or cerebral anæmia, and contra-indicated in cerebral hyperæmia.

Methylal has no injurious influence upon the heart, and leaves no bad after-effects.

Use and Doses.—Ointment. Potion, in doses of 1:100 to 150. Liniment, 1:6 or 1:10. Hypodermic injection.

Milk-Sugar.—Synonym: Lactose.

Therapeutical Properties.—Is the most powerful and at the same time the most harmless diuretic. To it alone is due the diuretic property of milk, to the exclusion of the other elements.

Milk in doses of four quarts, which represent ℥ viss. of lactose, causes a temporary diabetes together with considerable excretion of urea—glycosuria and azoturia. On the other hand, if lactose be given alone, it causes neither glycosuria nor azoturia.

The administration of ℥ iij. of lactose effects the excretion

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of 2½, and later of 3½ to 4½ quarts of urine. Dropsies cease rapidly under this treatment, at least those of cardiac origin. Renal dropsies are not affected by lactose, especially when the urine contains albumin.

The drug is well borne, but liquid food must be suppressed as much as possible and be replaced by solid nutriment of a kind to support the heart's action.

Use and Doses.—Three ounces of lactose may be dissolved in a quart of water flavored with a little rum or mint water. Dose, two quarts per day.

Mollin.—Preparation.—Lard is saponified in the cold by liquid caustic potassa mixed with a small quantity of soda lye. Then 30% of glycerin is carefully mixed with it by the application of heat.

Description.—Of a soft consistence which varies little under different temperatures, and of good keeping qualities; its color is dull yellowish-white; reaction neutral.

Therapeutical Properties.—Kirsten recommends it as an excipient for pomades used in skin diseases.

Mercurial mollin, in double the proportions of mercurial ointment, is easily prepared and very active.

Mollin with storax, tar, tannin, phenic acid, salicylic acid, red oxide of mercury, white precipitate, chrysarobin, ichthyol, sulphur, and thymol, are the medicaments recommended by Kirsten for use in dermatology.

Moussena.—Synonyms: Busenna, Acacia anthelmintica H. Br.

Description.—A plant belonging to the Order of Leguminosæ-Mimoseæ, indigenous to Abyssinia.

Composition.—Contains moussenin which, according to Thiel, is a glucoside, and, according to Gastinel, an alkaloid

Part Employed.—The bark.

Therapeutical Properties.—Anthelmintic and vermifuge.

Use and Doses.—Powdered bark, in doses of ʒ ij., either alone or mixed with honey or milk.

Myrtol.—Description.—A constituent part of an essential oil derived by distillation in presence of water from the leaves of Myrtus communis L., belonging to the Order of Myrtaceæ, indigenous to Africa.

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Myrtol distils between 338 and 347° F.

Therapeutical Properties.—Used in chronic bronchitis, blennorrhagia, and vaginitis; it is better tolerated than the balsamics.

Sedative and antiputrid, it stimulates digestion and improves the appetite.

Use and Doses.—Gelatin capsules, in doses of ♏ xvi.

Naphthalin.—Preparation.—In the distillation of coal-tar the portion passing over between 410 and 437° F. is collected. A crystalline mass is obtained which is impregnated with empyreumatic oil. For medicinal use, naphthalin is purified by being sublimed several times, and recrystallized.

Description.—Brilliant, white lamellæ, having a peculiar odor and an acrid taste; insoluble in water, soluble in alcohol and ether, melting at 174.2° F., boiling and subliming at 428° F.

Physiological Properties.—Naphthalin passes through the system and is eliminated through the urine which it colors brown. It is toxic in doses of ʒ iv. (Bouchard); it diminishes the appetite and in large doses causes diarrhœa and vomiting; does not act upon the heart or the circulation.

In the urine it appears as naphthylurea or naphthylcarbamide, and gives a rose color with acetic acid, a green color with sulphuric acid.

Therapeutical Properties.—Antiseptic, used in ointments for skin diseases. Internally it is employed, owing to its disinfectant properties, in phthisis, purulent bronchitis, and pulmonary gangrene. Professor Bouchard has used it in typhoid fever and obstinate diarrhœa. It is recommended as a vermifuge and an anthelmintic.

Use and Doses.—External use, ointment:

Lard, ...	ʒ vij.
Naphthalin, ...	gr. xv.

Solution:

Naphthalin, ...	ʒ i.
Alcohol, ...	fl. ʒ i.

For one quart. For internal use, wafers, containing gr. ⅛, one every hour. Pills of gr. ½, coated with keratin, to retard their action until they reach the intestines.

Naphthol.—Preparation.—Alpha naphthol. It is obtained

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by injecting powdered sulphonaphthalate of lead into fused potassa. It is purified by distillation in watery vapor and crystallization in boiling water.

Beta naphthol. Beta sulphonaphthalates of sodium or of lead are melted with potassa.

Description.—Alpha naphthol. White needles, fusing at 197.6° F., soluble in ether, chloroform, and alcohol, almost insoluble in water.

Beta naphthol. Small, brilliant, odorless flakes, fusing at 251.6° F.

Therapeutical Properties.—Beta naphthol is recommended by Professor Bouchard as an intestinal antiseptic in typhoid fever and as a gastric antiseptic in cases of dilatation. It is frequently combined with salicylate of bismuth.

According to Professor Rapon, it is a good remedy for scabies, although very irritating.

Use and Doses.—Externally, a solution of ʒ i. to ↄ iv. in O ij. of alcoholized water. Ointments made with lard or lanolin up to 10%, up to 5% in prurigo, and still weaker in eczema. Internally, Bouchard employs naphthol in doses of gr. iss.–ivss.

Naregamia alata W. and A.—Synonym: Ipecacuanha of Goa.

Description.—A plant belonging to the Order of Meliaceæ, derived from India.

Composition.—Contains an oil, wax, and an alkaloid, naregamine (Hooper).

Therapeutical Properties.—The sap of the plant is used in psoriasis. The root is emetic and cholagogue, serviceable in gastric disturbances, rheumatism, and indigestion. In small doses it is a useful expectorant in catarrhal affections and the bronchitis of children.

The tincture acts very well in emphysema by liquefying the sputa and diminishing the secretion.

Use and Doses.—Powder, gr. xviij. Tincture, gtt. ij.–vi. every hour.

Nectandra Puchuri L.—Description.—A plant belonging to the Order of Lauraceæ, indigenous to Guiana.

Physiological Properties.—Its taste is intermediate between sassafras and nutmeg.

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Therapeutical Properties.—Tonic and astringent; used as a medicament and as a condiment.

Nectandra Rodiæi.—Synonyms: Bibiru, Bebeeru.

Composition.—Contains two alkaloids, bibirine, $C_{18}H_{21}NO_3$, and nectandrine, $C_{20}H_{23}NO_4$ (Maclagan).

Therapeutical Properties.—It is used in migraine, periodical neuralgias, and menorrhagia. The alkaloid is given in intermittent fevers when quinine cannot be borne.

Use and Doses.—Decoction and wine, same preparations and doses as cinchona. Powdered bark, gr. xv.–xlv. Bibirine, gr. ¼ to gr. viij., in pills or solution.

Nerium Oleander L.—Synonym: Rose-bay tree.

Description.—A plant belonging to the Order of Apocynaceæ, indigenous to Algeria. Only the plant growing in hot climates should be used.

Parts Employed.—The leaves and the bark.

Composition.—Contains an alkaloid, oleandrin

Physiological Properties.—Acts powerfully upon the heart, but in a different manner from strophanthine and digitaline; it is a very active poison.

Therapeutical Properties.—In asystoly due to cardiac or renal lesions it acts as a heart tonic and augments the secretions. It promises to become very useful in cases where strophanthus is now given. It does not accumulate in the organism.

Use and Doses.—Hydro-alcoholic extract, gr. ⅛ to gr. i. per day; the dose is gradually and cautiously increased to gr. ij. Tincture (1:5), gtt. v.–x. per day.

Orthin.—Synonym: Orthohydrazin-paroxybenzoic acid.

Preparation.—This compound, discovered by Kobert, is the result of the combination of hydrazin with paroxybenzoic acid (an isomer of salicylic acid).

Description.—The substance itself is not stable, but its salts are stable, especially the hydrochlorate of orthin.

Physiological Properties.—Dogs easily bear a dose of gr. xv. for each 25 pounds of their weight without untoward accidents, but their urine possesses considerable reducing power. In man, however, grave symptoms of intoxication are observed, profuse sweats and collapse.

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Therapeutical Properties.—Unverricht has tried hydrochlorate of orthin clinically and has noted a very energetic antipyretic effect in typhoid fever, pneumonia, and acute articular rheumatism. Still, he advises care in its use.

Doses.—Gr. ivss.-viij., twice a day.

Orthosyphon stamineus.—Synonym: Java tea.

Description.—A plant belonging to the Order of Labiatæ, indigenous to Java.

Composition.—Contains a glucoside (Périnelle).

Therapeutical Properties.—Used in affections of the bladder, mainly stone and calculous cystitis.

Use and Doses.—Infusion, ʒ iv. in O ij. of water. Syrup prepared from the aqueous extract of orthosyphon dissolved with sugar in distilled water; fl. ʒ ss. of the syrup contains ♏ vij. of the extract (Périnelle). Powder, 3 ss. to ʒ iv.

Osmic Acid.—Preparation.—It is made by treating osmide of iridium with aqua regia and distilling several times.

Description.—Long prismatic needles, of a brilliant golden yellow color; having an odor of horse-radish and an acrid and burning taste; it stains the skin black. It melts at 104° F. and boils at 212° F. Soluble in water.

Bacteriological Properties.—A very powerful antiseptic.

Physiological Properties.—Its irritant vapor gives rise to disorders that may be fatal.

Therapeutical Properties.—Billroth has recommended it for hypodermic injection in neuralgia and sciatica.

Doses.—Hypodermic injections, about 5 minims of a solution of gr. iss. in ♏ clx. of distilled water.

Ouabaio.—Description.—Used as an arrow poison by the Somalis; it is derived from a plant determined by Poisson as Acokanthera Ouabaio, resembling the Carissa, Order Apocynaceæ.

Composition.—Arnaud has obtained from the aqueous extract, made from the root and the wood, a crystalline glucoside, ouabain, having the formula $C_{30}H_{46}O_{12}$. Ouabain is identical with strophanthin; it is likewise present in the Strophanthus glabra of the Gaboon.

This principle is white, odorless, somewhat bitter, slightly soluble in cold water, but completely soluble in boiling water.

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Its best solvent is concentrated alcohol slightly heated. It is insoluble in chloroform, absolute alcohol, and anhydrous ether; it melts at 392° F.

Physiological Properties.—According to Rondeau and Gley, gr. $\frac{1}{30}$ kills a dog weighing about twenty-five pounds in a few minutes.

Doses.—Given in the same doses as strophanthin, namely, $\frac{1}{600}$ of a grain.

Oxalate of Cerium.—Description.—A grayish-white powder, insoluble in alcohol and ether.

Therapeutical Properties.—Campardon has used it in nervous vomiting, especially that of hysteria.

Doses.—Gr. $\frac{1}{4}$ to gr. iss. daily (Simpson).

Oxynaphthoic Acid (*Alpha*).—$C_{11}H_8O_3$.

Preparation.—Carbonic acid under pressure, at a temperature of 248–284° F., is made to react upon an alkaline salt of alpha-naphthol.

Description.—This process yields colorless crystals in the shape of fine needles which dissolve with difficulty in cold water (about 1:30,000), but alcohol and ether dissolve about 10%. The odor recalls that of naphthol. Inhaled it causes sneezing. Carefully heated, it volatilizes without decomposing.

Bacteriological Properties.—Its antiseptic properties are superior to those of salicylic acid; *e.g.*, on agitating fl. 3 x. of fresh blood with a few grains of the latter acid putrefaction is not prevented; but if we substitute the same quantity of alpha-oxynaphthoic acid, the mixture may remain unaltered for weeks. In 1% strength the powdered acid will keep urine, extract of meat, and various meat broths absolutely free from any alteration. Phosphate of sodium increases the solubility of the acid in water, and a 1% oxynaphthoic solution will keep fish submerged in it for months without putrefaction. The presence of albumin or gelatin does not lower its antiseptic power. Mixed with putrid liquids, it rapidly arrests the offensive emanations (Helbig and Lubbert).

Powdered oxynaphthoic acid may serve as a disinfectant and deodorizer for closets, urinals, chamber vessels, spittoons, etc., as well as for all liquids in which the presence of albumin contra-indicates the use of sublimate; provided its more gen-

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eral use can be facilitated by its production at a lower price than that at which it is still quoted.

Owing to its toxicity, oxynaphthoic acid should never be used for the preservation of alimentary substances.

Therapeutical Properties.—It may be used in the dressing of wounds with no more danger than sublimate or iodoform.

Use and Doses.—Helbig has prepared a oxynaphthoic collodion in 0.5% strength, and oxynaphthoic cotton, from 0.1% to 1%.

Pambotano.—Synonyms: Calycandra Houstoni Rich. or Cordyla Houstonia.

Description.—A small shrub belonging to the Order of Leguminosæ-Schwartzieæ, flourishing in the warm parts of Mexico.

Composition.—Nicolas R. de Arellano, of Mexico, and Villejean and Bocquillon have analyzed the plant. They found tannin, fatty matters, a soluble resin, but no alkaloid. Bocquillon has isolated a glucoside. The active principles are soluble in water and alcohol.

Therapeutical Properties.—It is a bitter of the first order and is employed in fevers. In Mexico, Morales and Labato have obtained good results in the marsh fevers common in that country. In France, Valude, of Vierzon, has had good results in all fevers (marsh fever, typhoid fever, grippe, tuberculosis).

Use and Doses.—Tincture. Decoction. Valude recommends a decoction made with 2¼ oz. of the bark, to be taken at a dose. Elixir.

Pangium edule Reinw.—Description.—A plant belonging to the Order of Bixaceæ, indigenous to Java, the Indian Archipelagus, and the Molucca islands.

Physiological Properties.—According to Remy Chatel, it possesses powerful narcotic properties which act upon the cerebro-spinal system. The symptoms produced are: somnolence, cephalalgia, great nausea, vomiting, furious or hilarious delirium, often death.

The antidotes employed are the same as those generally recommended for narcotics.

Simple maceration in cold water extracts the toxic properties from the plant, and this fact, well known by the natives,

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is utilized by them to stupefy or kill the fish they desire to secure; to this end they throw pangium leaves or bark into the water courses.

The leaves contain large quantities of fatty matter which is used in domestic economy for alimentation. But care is taken to macerate them in cold water for some hours before use until they have become harmless, and even then they purge persons not used to them.

Therapeutical Properties.—The different parts of the plant are administered in Java as an anthelmintic, and the juice of the leaves gives good results in the treatment of chronic wounds.

Pao Pereira.—Synonym: Geissospermum læve H. B.

Description.—A large tree, belonging to the Order of Apocynaceæ, indigenous to Brazil.

Therapeutical Properties.—In Brazil, the bark enjoys a great reputation as a tonic and particularly as a febrifuge; it retards the heart-beats and the respiration. This effect, which seems to be due to an alkaloid, pareirine or Geissospermine, $C_{19}H_{24}N_2O_2$, has been studied by Bochefontaine and Cypriano de Freitas.

The hydrochlorate of pereirine, in gr. xxx. doses, was very efficacious in fevers which had resisted sulphate of quinine.

Use and Doses.—Decoction (℥ i. in O ij. of water), one to two wineglassfuls per day.

Paracresotinate of Sodium.—Synonym: Paraoxytoluate of sodium.

Description.—According to Demme, this salt is moderately soluble in water.

Therapeutical Properties.—It is employed as an antipyretic and acts very well [see, however, note of Translator to Cresotinic Acid] in the intestinal catarrh of children.

Dose.—From gr. xv. to gr. xlv. per day.

Parameria vulneraria Radi.—Description.—A climbing plant indigenous to the Philippine islands.

Part Employed.—The root.

Therapeutical Properties.—The balsam which exudes from the root is successfully used in skin diseases and for hastening the cicatrization of wounds.

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Parthenium Hysterophorus L.—Description.—A herb belonging to the Order of Compositæ, indigenous to America from Louisiana to Patagonia.

Composition.—Contains an alkaloid, parthenine (Tooward).

Therapeutical Properties.—Used in aphthæ due to intestinal fevers, mucous patches, syphilitic ulcerations, fungous ulcers, and white swelling.

Use.—In local applications.

Pedalium Murex L.—Description.—A plant belonging to the Order of Pedaliaceæ, indigenous to India.

Part Employed.—The fruit.

Therapeutical Properties.—Employed in dysuria, blennorrhagia, and inflammations of the urinary passages. Used as a lithontriptic and regarded as an aphrodisiac.

Use and Doses.—Infusion made from ʒ i. of the bruised fruit in O i. of boiling water; it is allowed to macerate for two hours and filtered; to be taken in twenty-four hours, in doses of fl. ʒ ij.

Peganum harmala.—Synonyms: Harmel or armel.

Description.—A plant belonging to the Order of Rutaceæ-Zygophyllaceæ, indigenous to Spain, Egypt, and southern Russia.

Physiological Properties.—The plant has a strong and disagreeable odor, similar to that of rue, and a persistently bitter and resinous taste.

Composition.—Contains two alkaloids, harmaline and harmine.

Part Employed.—The seeds.

Therapeutical Properties.—Sudorific, anthelmintic, emmenagogue, used in amenorrhœa.

Use and Doses.—Tincture (1:5), gtt. xxx.

Pellicle.—Description.—This name is applied to the thin medicamentous layer left upon the skin by the evaporation of collodion charged with medicinal principles.

Preparation.—As a basis a flexible collodion is prepared:

Officinal collodion, ...	fl. ʒ i.
Canada balsam, ...	♏ xvi.
Castor oil, ...	♏ ix.

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This collodion forms a supple, elastic, flexible, and but slightly contractile pellicle.

It serves for the preparation of the following pellicles:

Croton oil pellicle:

Flexible collodion,	7 parts.
Croton oil,	1 part.

Used as a rubefacient in tinea tonsurans.

Hydrate of amylene pellicle:

Hydrate of amylene,	℥ i.
Aconitine,	gr. $\frac{1}{12}$.
Veratrine,	gr. iv.
Collodion,	fl. ℥ i.

Used as a sedative and calmative in neuralgias, sciatica, and lumbago.

Cocaine pellicle:

Flexible collodion,	fl. ℥ ij.
Cocaine,	gr. xv.

Used as a calmative and anæsthetic.

Ichthyol pellicle:

Flexible collodion,	7 parts.
Ichthyol,	1 part.

Used in skin diseases (psoriasis, impetigo, and herpes).

Iodine pellicle:

Pure iodine,	gr. xxiv.
Flexible collodion,	fl. ℥ i.

Used as a revulsive and rubefacient.

Iodoform pellicle:

Iodoform,	1 part.
Flexible collodion,	2 parts.

Used as an antiseptic and for the external manifestations of syphilis.

Salicylic acid pellicle:

Flexible collodion,	fl. ℥ i.
Salicylic acid,	ʒ iv.

Used as an antiseptic, in skin diseases, ulcers, and fungous vegetations.

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Salicylic acid and chloride of zinc pellicle:

Salicylic acid,	℈ ij.
Chloride of zinc,	gr. xxiv.
Flexible collodion,	fl. ℥ i.

Used in ulcers and condylomata.

Corrosive sublimate collodion:

Corrosive sublimate,	gr. xiiss.
Flexible collodion,	fl. ℥ i.

Used as an antiseptic and antisyphilitic.

Lactic acid and salicylic acid pellicle:

Lactic acid,	ʒ iiss.
Salicylic acid,	ʒ iiss.
Flexible collodion,	fl. ℥ iij.

Used for dissolving vegetations and excrescences.

Styptic pellicle:
This is prepared by dissolving:

Concentrated alcoholic solution of tannin,	10 parts.
Tincture of benzoin,	11 "

This solution is added to:

Ether,	40 parts.
Gun cotton,	2 "

Mix and agitate.
Used in hemorrhages.

Vesicating pellicle:
This collodion is prepared thus:

Ethereal tincture of cantharides	50 parts.
Gun cotton,	2 "

Used as a vesicant.

Petiveria alliacea L.—Synonym: Congo root, Guinea-hen weed.

Description.—A shrub belonging to the Order of Phytolaccaceæ, indigenous to the Congo, to Guinea, and South America.

Therapeutical Properties.—The leaves are diuretic, sudorific, antispasmodic; used in ischuria, hysteria, dropsy, and yellow fever. In the Antilles, the root is used in toothache;

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in Porto Rico, it is given in the puerperium, to prevent accidents after labor.

Use and Doses.—Decoction, administered every fifteen minutes by the glassful.

Petiveria tetrandra.—Synonyms: Pipi or Guiné.

Description.—A plant belonging to the Order of Phytolaccaceæ, indigenous to Brazil.

Part Employed.—The root.

Therapeutical Properties.—Stimulant, sudorific in paralysis. Prophylactic.

Use.—Baths. Tincture for local friction, as a rubefacient.

Petroleum Ether.—Synonyms: Canadol, Kandol, Candahol [?].

Preparation.—A product of the distillation of naphtha, the portion coming over between 86 and 154° F. being collected. [This does not correspond to the petroleum ether, or rhigolene, used as an anæsthetic in this country.—*Transl.*]

Composition.—Consists of hydride of amyl, C_5H_{12}, and of hydride of caproyl, C_6H_{14}.

Description.—A very inflammable liquid, sp. gr. about 0.600 [?].

Therapeutical Properties.—It acts as a local anæsthetic, analogous to cocaine and ether; applied with an atomizer, it lowers the temperature in one minute to 14° F. It is employed in neuralgia and sciatica, and in minor surgery.

Phenacetin.—An acetylated derivative of phenetidin, in other words, of the ethylic ether of para-amidophenol.

Synonym.—Para-acetphenetidin.

Preparation.—Acetic anhydride or chloride of acetyl is made to react upon amido-phenetol. The paranitrophenol is employed to prepare the para-amidophenetol. This compound is reduced by hydrochloric acid and tin, thus producing para-amidophenol. If this last body is acted upon by iodide or chloride of methyl, para-amidophenetol results.

Description.—A slightly reddish, odorless and tasteless powder; very slightly soluble in water, more soluble in glycerin, freely soluble in hot alcohol. Fuses at 269.6° F.

Composition.—Its composition corresponds to the formula: $C_6H_4—O.C_2H_5—NH.(CO—CH_3)$.

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Therapeutical Properties. — Antipyretic and febrifuge. The lowering of the temperature which it produces is more lasting than that obtained by antipyrine, while it causes no rigor, nausea, or vomiting. It is said to have been successful also in the treatment of neuralgia. Koller, of Vienna, calls the attention of practitioners to the exaggerated and alarming lowering of the temperature which may follow the administration of phenacetin when it produces, in exceptional cases, profuse perspiration: once the temperature fell to 95° F.

Dujardin-Beaumetz emphasizes its febrifuge, analgesic, antipyretic, and antipolyuric properties which are equal to those of antipyrine and acetanilid.

Use.—Wafers of gr. iv.–viij., maximum dose gr. xxx.

Doses.—The most suitable dose for adults is about gr. viij., between gr. iij. and ix.

Phenol as an Anæsthetic.—Therapeutical Properties.—Hervetson emphasizes the anæsthetic properties of phenol. Toothache and earache (periostitis, chronic otorrhœa) are immediately relieved by the use of phenol.

Use.—Solution in glycerin:

Phenic acid, ...	1 part.
Glycerin, ...	4 parts.

Alcoholic solution 1:20.

Phenolate of Mercury.—Synonym: Carbolate of mercury.

Preparation.—Hugo Andres has searched for a mode of preparation by which a definite product is easily obtained.

He first prepares a phenolate of potassium by dissolving in 90% alcohol 94 parts of phenol crystals and 56 parts of hydrate of potassium. The alcoholic solution is evaporated on a water bath to a syrupy consistence, and then placed under a bell glass with sulphuric acid until completely desiccated.

One hundred parts of phenolate of potassium are dissolved in alcohol, and the filtered liquid precipitated with an alcoholic solution of 112 parts of sublimate.

An orange-colored precipitate is thus obtained which is placed on a filter and washed, first with 60% alcohol and finally with absolute alcohol until the filtered liquid no longer gives a precipitate with sulphuretted hydrogen.

Description.—The product, dried over sulphuric acid, ap-

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pears as a brick-red amorphous powder with a faint phenol odor. It readily dissolves by heat in hydrochloric acid, and on the addition of potassa the solution precipitates yellow oxide of mercury. Nitric acid also dissolves phenolate of mercury and on heating furnishes a golden yellow liquid. This phenolate is insoluble in water, chloroform, bisulphide of carbon, ether, and alcohol. It contains on an average 51.68% of mercury.

Phenylacetic Acid.—Preparation.—Chloride of benzyl is first transformed into cyanide of benzyl, then by submitting the latter to the action of boiling potassa, phenylacetic acid results.

Description.—It crystallizes in iridescent lamellæ; melts at 169.7° F. and boils at 509° F. Slightly soluble in cold water, freely soluble in boiling water, alcohol, and ether.

Therapeutical Properties.—Given in phthisis, it diminishes expectoration and cough, augments the forces, and favors nutrition.

Use and Doses.—Alcoholic solution in doses of gtt. x.-xx. in fl. ʒ ij. per day.

Phenylmethane.—Synonym: Diphenylmethane. Formula, $CH_2(C_6H_5)_2$.

Preparation.—A mixture of chloride of benzyl, benzin, and powdered zinc is kept at ebullition in a reflux apparatus. A hydrocarbon is obtained by distillation at 500° F.; this is diphenylmethane.

Description.—Crystals fusing at 77° F., having an orange odor. Soluble in alcohol, ether, and chloroform.

Therapeutical Properties.—According to Giacomini, of Turin, its effects are identical with those of antipyrine, in half the dose required for the latter. The same author ascribes to it not only antipyretic properties, but also antirheumatic and analgesic power.

Use and Doses.—Gr. viiss. suffice where gr. xv. of antipyrine would be required. It is dissolved in some suitable wine.

Phosphate of Copper.—Therapeutical Properties.—Luton maintains that tuberculosis can be cured by means of phosphate of copper in a nascent state and rendered soluble in an alkaline medium. In this combination the copper would play

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a specific part, and the phosphorus that of a dynamic agent, and he adds that the indication is to give a special tonic after the specific medication, in order to establish the cure and prevent relapses.

Use.—Pills, potions, hypodermic injections.

Doses.—Pills of aceto-phosphate of copper:

Neutral acetate of copper, ...	gr. $\frac{1}{6}$.
Crystalline phosphate of sodium, . .	gr. $\frac{3}{4}$.
Licorice powder and glycerin, . . .	q.s.

to make one pill.

Potion of aceto-phosphate of copper:

Neutral acetate of copper, . . .	gr. $\frac{3}{4}$.
Crystalline phosphate of sodium, . .	gr. ix.
Mucilaginous mixture, ...	fl. ℥ iij.

In tablespoonful doses; number to be determined.

Phosphate of copper mixture for hypodermic injection:

Phosphate of copper, recently precipitated, .	gr. $\frac{1}{4}$.
Pure glycerin and distilled water, . . .	fl. ʒ i.

Mix immediately before using.

Luton recommends an initial dose of gr. iss. of the copper salt.

Phthalate of Morphine.—Preparation.—Phthalic acid is prepared by oxidizing naphthalin with sulphuric acid and bichromate of potassium.

Bombelon has combined phthalic acid with morphine.

Absolutely pure ingredients are required. The morphine must be several times reprecipitated from its crystalline salts in order to answer for the combination.

Description.—An amorphous, non-crystallizable body.

Therapeutical Properties.—Suitable for subcutaneous injection of morphine; it keeps for a long time, and the phthalic acid is free from the therapeutical inconveniences of the mineral acids combined with morphine.

Use and Doses.—A 2% solution, of which one syringeful is injected, about gr. $\frac{1}{3}$.

Phyllanthus Niruri L.—Synonyms: Yerba de quinino, Creole quinine.

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Description.—A plant belonging to the Order of Euphorbiaceæ, indigenous to Porto Rico, Reunion, and Cochin-China.

Therapeutical Properties.—An excellent bitter tonic, diuretic, and deobstruant.

Held in high esteem as a specific in intermittent fevers, and which may even be used as a prophylactic.

The sap is used on indolent sores and parasitic skin diseases.

In repeated doses it is purgative and therefore suitable in intermittent fevers of a splenetic and hepatic form.

Use and Doses.—Powder, in 3 i. doses. Tincture (1:5), fl. 3 ij., to be taken in the morning.

Phytolacca decandra.—Synonym: Poke root.

Description.—A plant belonging to the Order of Phytolaccaceæ, indigenous to North America.

Therapeutical Properties.—The root is emetic, purgative, and slightly narcotic. The vomiting produced is not associated with pain or spasms. Alterative, resolvent, deobstruent, antisyphilitic, and antiscorbutic. Externally, it is used in the form of an ointment for sycosis and favus.

Daniel has given it internally in the treatment of orchitis.

The resinoid, called phytolaccin, possesses cholagogue properties.

Use and Doses.—Powdered root, as an emetic, gr. ix.–xxx.; as an alterative, gr. ¾–ivss. Fluid extract, gtt. x.–xxx., every three or four hours. Resinoid (phytolaccin), gr. i.–iv. Externally, as an ointment, alone or associated with belladonna.

Picão da praia.—Synonym: Acanthospermum xanthioides D. C.

Description.—A plant belonging to the Order of Synantheræ, indigenous to Brazil.

Part Employed.—The entire plant.

Therapeutical Properties.—Tonic and diuretic, used in intermittent fevers; it is a popular remedy for gonorrhœa. The seeds are poisonous to birds.

Use and Doses.—Infusion prepared from gr. iij. of picao in fl. ℥ ss. of water for a dose. This is repeated three times a day.

Picrate of Ammonium.—Preparation.—A solution of picric acid is saturated with carbonate of ammonium or with ammonia. After careful concentration, it is allowed to crystallize.

Description.—Yellow, bitter needles; soluble in water and

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slightly soluble in alcohol; it must be handled with care. Formula, $C_6H_2(NO_2)_3,NH_4O$.

Therapeutical Properties.—Antipyretic and antiperiodic, used by Clarck and Studenezki in intermittent fevers.

It is regarded as an antipyretic inferior to quinine and does not lower the temperature as much as the latter, but has the advantage of not causing any gastric disturbances, but rather to suppress them when they exist. It is said to be indicated in patients suffering from the apyretic form of malaria who are free from cachexia. It should be administered on the day of remission.

Use and Doses.—In wafers, in doses of gr. v. in twenty-four hours.

Pilocarpine.—Description.—An alkaloid extracted from jaborandi, Pilocarpus pennatifolius, belonging to the Order of Rutaceæ, indigenous to Brazil and the Argentine Republic.

An amorphous, viscous substance, slightly soluble in water, freely soluble in alcohol, ether, and chloroform. Formula, $C_{46}H_{34}N_4O_8,4HO$.

It combines with hydrochloric acid and forms a hydrochlorate which crystallizes in long needles radiating from a common centre; soluble in water, alcohol, and chloroform; insoluble in ether.

The acetate is soluble in water, alcohol, chloroform, and ether; insoluble in bisulphide of carbon.

Owing to its stability, the nitrate is preferable.

Besides pilocarpine, jaborandine and pilocarpidine have been discovered in jaborandi.

Reaction.—Gives a yellow color with sulphuric acid, and an emerald green color on the addition of bichromate of potassium.

Physiological Properties.—Increases the secretion of tears, saliva, and sweat. It produces a rapid contraction of the pupil; the action commences at the end of ten minutes and persists from two to five hours. It possesses a narcotic effect and is an antidote of atropine.

Therapeutical Properties.—It has taken the place of jaborandi, whose properties it possesses in a more marked degree.

It is used in ophthalmology for contracting the pupil in cases of iritis and glaucoma.

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Sialogogue and powerful diuretic, used in uræmia. Prescribed with good results in diabetes insipidus, puerperal albuminuria, and eclampsia. Stimulant, used in hepatic colic, acute nephritis, dropsy, and Bright's disease.

Guéneau de Mussy has obtained good results in chronic urticaria.

It has been used, but with small success, in hydrophobia. It is sometimes used as an antidote in belladonna and morphine poisoning.

Externally, it is used in prurigo, and alopecia; it has the property of making the hair grow, the new growth being dark though the original hair was light.

It has been occasionally given hypodermically in locomotor ataxia, traumatic or rheumatic tetanus, diphtheria, and syphilis.

Use and Doses.—Infusion of the plant [Pilocarpus], ʒ iv. in O ij. Aqueous extract, gr. viij.–xxiv. in twenty-four hours. Hydro-alcoholic extract, gr. iv.–xij. per day. Tincture (1:5), gtt. xxx.–fl. ʒ i. Powdered leaves, gr. iv.–ʒij. Alkaloid, in granules of from gr. $\frac{1}{6}$ to $\frac{1}{3}$. For subcutaneous injection a solution is made of gr. iv. in fl. ʒ viij. of water, of which ♏ xvi. are injected, about gr. $\frac{1}{8}$. For collyria, a solution of gr. ij. in ♏ clx. of water, of which gtt. i. is instilled.

Piperonal.—Synonym: Heliotropin. Formula, $C_8H_6O_3$.

Description.—An aldehyde corresponding to piperonylic acid. Insoluble in water, soluble in alcohol and ether.

Preparation.—Obtained by the oxidation of piperine.

Therapeutical Properties.—Antipyretic and antiseptic.

Doses.—Gr. xv.–xlv.

Piscidia Erythrina L.—Synonym: Jamaica dogwood. The plant owes its name to the striking color of its red flowers and the stupefying effect it has upon fish.

Description.—A shrub belonging to the Order of Leguminosæ, Tribe Dalbergieæ, indigenous to India.

Therapeutical Properties.—Landowski confirms the sedative and soporific properties of this plant which have been described by Ott and Hamilton. Landowski used the fluid extract, prepared according to the U. S. Pharmacopœia.

Hutchison, of Glasgow, has used the fluid extract with good results in phthisis, bronchitis of miners, dry catarrh,

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facial neuralgia, insomnia, sciatica, and whooping cough. It is a sedative in neuralgia, migraine, and mania.

Use and Doses.—Fluid extract, ʒ ss.–i. Decoction of the bark, ʒ i. Tincture, ♏ xvi.–xlviij. per day. Syrup, containing gr. xv. of the extract to each spoonful.

Plantago hispidula Rz. and P.—Synonym: Plantago recumbens.

Description.—Seeds from an Indian plant of the Order of Plantagineæ, resembling Psyllium; they are very light—160 seeds weigh gr. iij. and furnish a large quantity of mucilage.

Therapeutical Properties.—Antidiarrhœic. Used in cough and colds. Mixed with sugar they form a Chinese dainty.

Doses.— ʒ iiss. of the powdered seeds in sugar water.

Pleurogyne rotata Griseb.—Description.—A plant belonging to the Order of Gentianaceæ-Chironeæ, indigenous to Japan.

Therapeutical Properties.—Tonic, a very powerful bitter, frequently used in Japan. The plant is used for the same diseases and in the same doses as gentian.

Plaster Mulls.—Synonym: Unna's plaster mulls.

Preparation.—L. Cavaillès proposes the following method: Incorporate the medicament into a solution of gutta percha in benzin, evaporate the benzin at a gentle heat, and spread the plastic mass over the muslin. The plaster thus obtained is very thin, flexible, adhesive, and perfectly impermeable to air; the coating of gutta percha never cracks; it becomes so thoroughly incorporated that the plastic mass never separates from the muslin nor does it remain adherent to the diseased part.

It is generally necessary to dissolve the active principle in lanolin before being incorporated into the benzin solution of gutta percha.

Cavaillès uses this method in preparing the following medicated plasters which have been tried at the Hôpital Saint-Louis.

Pyrogallic acid, ...	42%.
Salicylic acid, ...	38–50%.
Salicylic acid, ...	20%.
Creosote, ...	40%.

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Salicylic acid,	60%.
Extract of cannabis indica,	15%.
Extract of belladonna,	30%.
Chrysarobin,	15–45%.
Emplastrum de Vigo,	60%.
Emplastrum de Vigo,	30%.
Carbolic acid,	15%.
Corrosive sublimate,	3%.
Oxide of zinc,	15%.
Iodoform,	50%.
Resorcin,	50%.
Ichthyol,	5%.
Boric acid,	20%.
Red oxide of mercury,	10%.
Aristol,	5%.
Salol,	50%.
Oil of cade,	50%.

Therapeutical Properties.—Recommended by Unna, of Hamburg, they are used in certain affections of the skin, lupus, psoriasis, eczema, and herpes.

Plumbago zeylanica L.—Synonym: Leadwort.

Description.—A plant belonging to the Order of Plumbagineæ, derived from India and Ceylon.

Therapeutical Properties.—The fresh stems are vesicant and caustic.

After desiccation they stimulate digestion, improve the appetite, and are used in diarrhœa, hemorrhoids, dyspepsia, and skin diseases. The plant is reputed to be an abortifacient. The tincture is an antiperiodic and energetic sudorific.

Plumiera alba L.—Synonyms: Red jasmine.

Description.—A plant belonging to the Order of Apocynaceæ, indigenous to the Antilles.

Therapeutical Properties.—Alterative, depurative, purgative, and antisyphilitic. The bark is efficacious in blennorrhagia.

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The milky sap is toxic and irritant, similar to that of the Euphorbiaceæ.

Use.—The decoction is taken with meals, like an ordinary drink, in doses of one pint daily.

Australian Pepper.—From Piper Novæ Hollandiæ.

Description.—A plant belonging to the Order of Piperaceæ, indigenous to Australia.

Therapeutical Properties.—Tonic, stimulant, recommended by Bancroft in blennorrhagia and mucous flux. Employed externally as a rubefacient.

Polygonum Hydropiper L.—Synonym: Smartweed.

Description.—A plant belonging to the Order of Polygonaceæ, growing in European marshes.

Therapeutical Properties.—Emmenagogue. Has been studied by Professor Eberle who states that it is one of the best emmenagogues and abortifacients. The fluid extract has produced abort in animals.

Use and Doses.—Fluid extract, cold prepared, gtt. v.–xxx., three or four times a day.

Polypodium adiantiforme.—Synonym: Calaguala.

Description.—A plant belonging to the Order of Filices, indigenous to South America.

Therapeutical Properties.—Amadeo has used it with success in the secondary and tertiary manifestations of syphilis. The decoction allays the osteocopic pains; the treatment must be kept up for two or three months.

Use and Doses.—Decoction or infusion, in doses of ʒ i. in O i. of water, to be taken every day.

Pongamia glabra Vent.—Description.—A tree belonging to the Order of Leguminosæ-Dalbergieaæ, indigenous to India, China, and Australia.

Therapeutical Properties.—The oil is used in scabies, herpes, and other skin diseases, also in rheumatism. Gibson claims that he knows no other plant whose properties are equally marked in the treatment of these diseases.

Dymock states that this oil possesses all the advantages of iodoform and of Goa powder, without any of their inconveniences, and that it acts favorably also in lepra and pityriasis.

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Psoralea corylifolia L.—Synonym: Bauchée.

Description.—A plant belonging to the Order of Leguminosæ, derived from India.

Therapeutical Properties.—The seeds are stomachic and deobstruent; the oleoresin from the seeds is used with success in leprosy, elephantiasis, and various skin diseases, especially squamous eruptions.

Ptychotis Ajowan D. C.—Description.—A plant belonging to the Order of Umbelliferæ, indigenous to India, Persia, and Egypt.

Composition.—Contains thymol and cymene.

Bacteriological Properties.—A powerful antiseptic.

Therapeutical Properties.—Employed locally as a stimulant embrocation in rheumatism; it is given in flatulence, diarrhœa, colic, and atonic dyspepsia. Tonic, carminative, and antirheumatic.

Use and Doses.—Maceration (℥ iiss. in fl. ℥ iij. of water), fl. ℥ i.–ij. The oil from the seeds, gtt. i.–iij. upon sugar.

Pyoktanins.—Synonyms: Pyoktanines, proctene, and bacterioktene; from πῦον pus, and κτείνειν to kill.

Description.—Violet (methyl violet) or yellow (auramin) anilin colors.

Bacteriological Properties.—Professor Stilling, of Strasburg, has studied the antibacteric action of these anilin colors. In his investigations pursued together with Dr. Vortmann he made use of methyl violet. A 1:1,000 solution will preserve meat for more than six days at a temperature of 77° F., without the development of bacteria.

In a 1:3,000 solution of water containing extract of meat and sugar, Penicillium glaucum does not form. The bacteria of pus are killed by contact with a solution 1:64,000 of water.

Physiological Properties.—Experiments performed on animals give the following results. Under the influence of a 1:1,000 solution the eye of a rabbit assumes a deep violet color which disappears, however, by the next day. If methyl violet in substance is introduced into the conjunctival sac, an intense color is produced and during the following days the epithelium becomes detached in large flakes showing profound fatty degeneration. But this débris, as well as the entire conjunctival sac, are free from bacteria.

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Of a 1:1,000 solution fl. 3 vss. may be injected under the skin of a rabbit or Guinea-pig, apparently without causing any suffering to the animal. The animal will bear only half that dose by peritoneal injection. Under larger doses the animal succumbs; all the viscera are colored except the vessels. Death occurs under these circumstances by impregnation of the nerve centres, whose action is suspended. If the violet is administered to the rabbit by being mixed with the food, it will bear a dose of a few drachms without ill effects. Finally, Stilling was able to inject it into the lungs without any inconvenience. The materials must be pure. Some coloring matters are dangerous; such is the case with ethyl violet, which contains arsenic.

Therapeutical Properties.—These authors have obtained the best results from the application of this substance in surgery and in ophthalmology, for the treatment of wounds and ulcerations. According to them, it is superior to corrosive sublimate. They have tried a blue pyoktanin in surgery, and a yellow pyoktanin (auramin) in ophthalmology. They are not toxic; they are odorless and healing.

Use and Doses.—Powder. Ointments, 1% and 2%. Cotton and gauze, 1%.

Inconveniences.—They color the skin, but the stains will disappear under the application of a solution of hypochlorite of sodium or of tincture of soap.

Pyrodin.—Synonym: Acetylphenylhydrazin.

Description.—A preparation the principal element of which is acetylphenylhydrazin ($C_6H_5—NH_2—C_2H_3O$). It is a white, crystalline powder, difficultly soluble in cold water; it greatly resembles antithermin which is a compound of phenylhydrazin and levulinic acid.

Therapeutical Properties.—Dreschfeld, of Manchester, has administered it in different varieties of fever. He concludes that this compound is an energetic antipyretic, especially applicable in cases of pneumonia, scarlatina, and typhoid fever; it rapidly lowers the temperature, keeps it for several hours at a point but slightly above the normal, and causes marked perspiration, without nausea, vomiting, or collapse.

Use and Doses.—In wafers of gr. ¼, one to be taken an hour before the onset of the fever, another four hours later. Maxi-

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mum daily dose, gr. iss. Administered in repeated doses and at short intervals, it easily produces toxic symptoms, by hæmoglobinæmia. For this reason it should be given, excepting uncommonly high temperature, only once in eighteen or twenty-four hours, and it is not advisable to continue its exhibition longer than a few days. But, on the other hand, as pyrodin is a much more active antipyretic than antipyrine, antifebrin, or phenacetin, it is rarely necessary to give it more than once in twelve or eighteen hours; gr. ij.–iij. for children, gr. vi.–ix. for adults.

Quebracho.—Synonym: Aspidosperma Quebracho.

Description.—A tree belonging to the Order of Apocynaceæ, indigenous to Chili.

Composition.—Contains a large amount of tannin, and an alkaloid, aspidospermine. The salts are soluble in water. It contains two sugars, quebrachite and lævogyre inosite (Tanret).

The alkaloid, soluble in alcohol and ether, slightly soluble in water, possesses the taste and physiological effect of quinine.

Part Employed.—The bark.

Therapeutical Properties.—Febrifuge and tonic, in the same degree as cinchona. Used in diseases of the respiratory passages it acts as an antipyretic in dyspnœa; its effects are good in emphysema, bronchitis, and pleurisy. The tincture hastens the cicatrization of wounds and burns; it prevents inflammation and the formation of pus.

Use and Doses.—The bark, plain or in wafers, ʒ iiiss. per day. Fluid extract, fl. ʒ i. Tincture (1:5), fl. ʒ ss.–ij.

Rauwolfia canescens W.—Description.—A plant belonging to the Order of Apocynaceæ, indigenous to the Antilles.

Therapeutical Properties.—The sap is very poisonous, and when absorbed produces inflammation of the intestinal canal. Mixed with castor oil, the extract from the bark is used with success in the treatment of parasitic diseases of the skin. The infusion of the bark is serviceable in syphilitic ulcerations.

Resorcin.—Formula, $C_6H_6O_2$.

Preparation.—It is formed by the action of fused potassa on galbanum, gum-ammoniac, and various other organic bodies.

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It is generally prepared by fusing benzoldisulphonic acid with potassa; the resulting salt is then decomposed with hydrochloric acid.

Therapeutical Properties.—Antiputrid, antifermentative, coagulates the albuminous liquids of fibrin in the system.

Leblond found that this substance aids materially in the dissolution of false membranes and effected a cure in cases in which other treatment had failed.

Moncorvo praises its effects in the treatment of whooping cough. He claims this disease to be due to a parasite, a micrococcus which proliferates in prodigious numbers on the mucous membrane covering the subglottic region of the larynx. In all cases in which resorcin had been applied directly, he succeeded in diminishing the coughing fits rapidly in number and reducing their intensity, a cure being effected within twenty days to one month.

It possesses anti-emetic effects.

Use and Doses.—Brushing with the following solution:

Resorcin, pure, ...	gr. xv.
Distilled water or glycerin, . . .	fl. ʒ ss.

A curved pencil on a long handle is used. One brushing every hour, day and night. Internally, ʒ ss.–i.

Rhamnus Alaternus L.—Description.—A plant belonging to the Order of Rhamnaceæ, indigenous to North America.

Therapeutical Properties.—Suppresses or diminishes the lacteal secretion; it is also prescribed in intermittent fevers.

Use and Doses.—Infusion, gr. xxx.–xlv. in fl. ʒ v. of water.

Rhamnus catharticus L.—Synonym: Purging buckthorn.

Description.—A plant belonging to the Order of Rhamnaceæ, indigenous to Europe and North America.

Part Employed.—The bark.

Therapeutical Properties.—Besides the purgative property of the bark which is well known, the peasants of southern Russia are in the habit of using a decoction of the bark as a gargle in toothache. Gretschinsky, who has prescribed this decoction as a gargle to be repeated every five minutes, has observed that the pain disappears in half an hour, but an itching and a dull sensation remain. In order to stop the pain completely, he directs a piece of wadding to be saturated with

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the decoction and inserted into the tooth. The result is good, especially in the case of pulpitis.

Use.—Decoction:

Bark, ...	100 parts.
Boiling water, ...	q. s.

After clarification, 200 parts of the liquid remain, to which 10 parts of alcohol are added.

Rhamnus coriaceus.—Physical Properties.—The bark, when chewed, produces salivation with heat in the mouth. This sensation is followed by prickling which is not disagreeable; its taste is bitter and tart.

Therapeutical Properties.—Tonic and slightly purgative; in large doses it is cathartic, but not violently so.

Use and Doses.—Fluid extract, ♏ xvi. to fl. ʒ ij., once or twice a day.

Rhamnus Purshiana.—Therapeutical Properties.—Laxative and cathartic, used in constipation.

Use and Doses.—Fluid extract, gtt. 30–50.

Rhinacanthus communis Nees.—Description.—A plant belonging to the Order of Acanthaceæ, indigenous to India and Japan.

Composition.—The active principle is rhinacanthine.

Therapeutical Properties.—This is a Siamese remedy, valued for its affects upon herpetic eruptions, hard excrescences of the skin, impetigo, eczema, and other diseases of the skin.

Use.—The extract dissolved in some alcohol is applied to the affected parts, after which they are washed for a long time with warm water.

Rhus aromatica Ait.—Synonym: Aromatic sumac.

Description.—A shrub belonging to the Order of Terebinthaceæ, indigenous to North America.

Therapeutical Properties.—In the United States it has been recommended in diabetes. It acts as a stimulant on the muscular fibres of the bladder and uterus. Unna recommends it as a specific in the incontinence of urine in children. It is also given in menorrhagia, hemorrhages, and the sweats and diarrhœa of phthisis.

Use and Doses.—Soft extract, gr. ij.–ix., morning and evening. Fluid extract, fl. ʒ i. Powdered plant, ℈ ij. per day.

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Ricin.—An albuminoid substance extracted by Tuson from the seeds of Ricinus communis.

Physiological Properties.—Introduced into the system by hypodermic or intravenous injection, ricin causes multiple hemorrhages on the surface of the intestinal mucosa, first in that of the small intestine, and secondarily in the stomach and large intestine. The toxic dose for a man weighing about 150 pounds is from gr. $\frac{1}{10}$ by hypodermic injection to gr. $\frac{9}{10}$ by the digestive canal. The physiological action is exerted mainly on the blood. In defibrinated blood it induces a kind of melting of the red corpuscles and gives them an aspect resembling an ordinary clot; placed in contact with blood recently drawn from the veins it causes immediate coagulation.

Rosinol.—Synonyms: Retinol, resinol, resin oil.

Preparation.—The products of the distillation of resin comprise three principles: 1, an essential oil; 2, a more fatty oil, resinol; 3, tar.

Description.—A clear yellow oil, in appearance resembling oil of sweet almonds, having a faint peculiar taste and odor, and absolutely neutral in reaction.

Composition.—In accordance with its origin and preparation it contains different bodies such as terebene, colophane, modified resin, cresylol, phenic acid, and creosote.

Therapeutical Properties.—Used as an antiseptic, tonic, insulator, modificator, and cicatrizer.

It finds a number of applications. To the surgeon it is useful both for local application and for injection or introduction on charpie. Applied on tampons in vaginitis and metritis, it is almost a specific in these affections. It may be employed like oils, cerate, ointments, vaselin, etc., in a large number of cases, such as burns, hemorrhoids, affections of the skin, etc.

It is administered in teaspoonful doses in septic fevers, is also indicated as a general anticatarrhal remedy, and used in the form of capsules. It is employed with success in the treatment of colds, bronchitis, laryngitis, etc.

In America it has been given in capsules for blennorrhagia.

It is used as an excipient and a solvent for oil of cade, salol, camphorated naphthol, and balsam of Peru.

Use and Doses.—Internally, in capsules of ℥ viij., four to

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six per day. Externally, applied on tampons or in an emulsion.

Rubus chamæmorus L.—Synonym: Cloudberry.

Description.—A plant belonging to the Order of Rosaceæ, indigenous to Russia and Canada.

Composition.—Professor S. Popoff has succeeded in extracting from it an acid in the form of a colorless powder, slightly soluble in water, freely soluble in alcohol; with bases this acid forms crystalline salts which are very soluble in water. This acid is the active principle of the plant.

It acts directly on the kidney without affecting the heart-beats or the blood pressure.

In order to obtain the acid pure, Popoff advises to treat the dried berries with warm alcohol slightly acidulated with hydrochloric acid. After filtering, the alcohol is passed through animal charcoal. Distilled water is added to the cooled alcoholic solution when the acid is deposited in the form of small flakes. Popoff has found no alkaloid in the plant.

Therapeutical Properties.—In northern Russia the people use it as an excellent diuretic and sudorific.

Frinkowski first determined its diuretic effects. Popoff praises the diuretic effects of decoctions and extracts prepared from the fresh plant.

Use.—Infusions are made from the berries, the flowers, and even the leaves.

Rumex crispus L.—Description.—A plant belonging to the Order of Polygonaceæ, indigenous to North America.

Composition.—The active principles are about the same as those of Rhubarb.

Therapeutical Properites.—Depurative, alterative, and tonic, well recommended in the treatment of obesity.

Use and Doses.—Tincture (1:10), gtt. v.–xx.

Sabattia angularis Pursh.—Synonym: Chironia angularis Mich.

Description.—A plant belonging to the Order of Gentianaceæ, indigenous to the United States.

Composition.—Contains erythrocentaurin.

Therapeutical Properties.—Very bitter tonic, non-astringent, popularly used in intermittent and remittent fevers. It stimulates the appetite and improves digestion.

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Use and Doses.—Powdered plant, ʒ ss.–i. Infusion (℥ i. in fl. ℥ iij. of water), fl. ℥ i.–ij.

Saccharin.—Synonym: Anhydro-sulphamidobenzoic acid. Saccharin was discovered in 1879 by Fahlberg.

Preparation.—Toluene is changed into its sulpho-compound by means of sulphuric acid of 66°. This is saturated with lime so as to obtain sulphotoluates of lime. These are changed into alkaline salts by the addition of carbonate of sodium. The soda salt formed is separated by filtration and dried. This salt is treated with dry pentachloride of phosphorus. The result is two sulphochlorides of toluene, one soluble, the other liquid. The latter alone furnishes saccharin.

The liquid chloride formed is thoroughly washed, cooled with ice, air dried, and transformed into sulphamide of toluene by means of carbonate of ammonium and heat. Carbonic acid is disengaged, and the product consists of chloride of sodium and sulphamide of toluol. The residue is reduced to a thick liquid with water and passed through a filter press; the chloride of sodium is eliminated by washing and the amide remains behind, since it is almost insoluble; it is then dried in a centrifugal apparatus. The amide must now be transformed by oxidation into a saccharin salt, and the latter into pure saccharin. The former operation is effected by the combined action of permanganate and peroxide of lead. The resulting product consists of orthosulphaminebenzoic acid combined with an alkali, a free alkali or alkaline carbonate, and a hydrated peroxide of manganese in a finely divided state. The saccharin must be precipitated from its saline combination which is done by means of hydrochloric or sulphuric acid, and the pure saccharin thus obtained is crystallized in water.

Description.—Slightly soluble in water, of an acid reaction, does not affect polarized light, and lacks the essential character of sugar to produce alcohol by fermentation.

The only point in which it resembles sugar is its sweet taste, but it differs in the following particulars: 1. Saccharin is 280 times sweeter than sugar. 2. Its taste is more persistent. 3. When placed on the tongue it produces a dry and acrid sensation in the pharynx. In large quantity saccharin exhales an odor of bitter almonds which is increased by heat.

Physical Properties.—According to Adeno and Masso, sac-

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charin is innocuous, is eliminated in the urine unchanged, but passes neither into the milk nor into the saliva; introduced under the skin it is absorbed. Salkowski has arrived at the same results, but Worms has demonstrated that saccharin does not agree with every stomach. The accidents attributed to it may have been due to its impurity, or to some antifermentative action which suspends the digestive power of the gastric or pancreatic juices, or to the permeability or non-permeability of the kidneys. In this respect saccharin resembles salicylic acid. These two substances, closely related to each other, seem to cause danger when ingested by patients whose kidneys are not in good condition. The French and Spanish governments have prohibited the use of saccharin in alimentary substances, while Switzerland, England, and Austria see no harm in its employment.

Therapeutical Properties.—Its sweetening power and its inactivity on the liver make it suitable for sweetening the food and drink of diabetics. It is also used in obesity to lessen the tendency to stoutness.

Its antiseptic properties have been utilized for gastric and intestinal antisepsis, and for washing the bladder. Constantin Paul has shown the antiseptic power of saccharin and has demonstrated that it prevents the development of the microbe of septic fever and erysipelas, as well as that of blennorrhagia.

Use.—In tablets of gr. ¾. In injections for gonorrhœa and cystitis.

Doses.—Gr. ¾ for sweetening a cup of tea; it is prescribed with an equal weight of bicarbonate of sodium.

Saccharide of Casein.—Description.—A mixture of one part of dry casein with nine parts of sugar, rendered alkaline by bicarbonate of sodium.

Therapeutical Properties.—Recommended by Léger for preparing emulsions of fixed and ethereal oils, balsams, and turpentines. It also emulsifies resins, gum-resins, and their tinctures.

Salicylate of Bismuth.—It exists in two forms:

The acid salt, $(Bi_2O_3)_3(C_{14}H_6O_4)_5$.

The basic salt, $Bi_2O_3C_{14}H_6O_4$—$2Bi_2O_3,C_{14}H_6O_4$.

Preparation.—The acid salt is first obtained by precipitat-

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ing a solution of pure acid nitrate of bismuth by a solution of salicylate of sodium. The precipitate is collected and dried.

The basic salt is obtained by washing the preceding with distilled water until the wash water is no longer colored by perchloride of iron.

Composition.—The acid salt contains 50% of oxide of bismuth and 40% of salicylic acid.

The basic salt, 76% of the oxide, and 23% of salicylic acid (E. Schmidt).

Salt Used.—The basic salicylate is used therapeutically.

Description.—A well-defined, white, crystalline salt, very slightly soluble in water, alcohol, and glycerin; it should give no reaction with perchloride of iron.

Therapeutical Properties.—Has been successfully used in the treatment of typhoid fever.

It has been recommended for diarrhœa prevailing during epidemic cholera.

Bouchard recommends it as an intestinal and gastric antiseptic (dilatation of the stomach).

It is a good remedy for gastric catarrh.

Finally, it has given excellent results in internal medication.

Use and Doses.—As a powder or in wafers, in doses of from gr. xv. to ʒ i.

Salicylate of Lithium.—Preparation.—Saturate a hot solution of salicylic acid with carbonate of lithium.

Description.—A crystalline powder, very soluble in water.

Therapeutical Properties.—It is specially recommended in cases in which the joints remain stiff and painful after the use of salicylate of sodium, in subacute progressive rheumatism, and in primary chronic articular rheumatism.

Use and Doses.—Wafers. Potion. Elixir. Solution, taken during or after meals.

According to Vulpian, the active dose for adults is ʒ i. No appreciable effect is produced with smaller doses.

Salinaphthol.—Synonym: Salicylate of naphthol.

Preparation.—Salicylic acid is combined with beta-naphthol, in like manner as salol (which see).

Description.—A solid white substance, insoluble in water, odorless and tasteless.

Therapeutical Properties.—Has been studied by Kobert

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and Lépine who accord to it antipyretic, antirheumatic, and antiseptic properties.

Proposed as a substitute for salol, being better borne in acute articular rheumatism. It does not affect the stomach and causes neither headache nor tinnitus aurium.

It is decomposed into its constituents in the intestines, under the influence of the intestinal juices; appears in the urine in the form of salicyluric acid.

Use and Doses.—In wafers, in doses of gr. ivss.-viij., four times a day.

Salix nigra Michx.—Description.—A shrub belonging to the Order of Amentaceæ-Salicaceæ, indigenous to North America.

Therapeutical Properties.—The stalk is tonic, febrifuge, bitter, and carminative. The bark is a powerful sedative for the genital nerves of both sexes. It produces most favorable results in hysteria, hyperæsthesia, contractures, facial and urethral neuralgia, seminal losses, nymphomania, leucorrhœa, and prostatorrhœa.

The root is purgative and febrifuge.

This plant may advantageously be substituted for bromide of potassium in all its indications [?].

Use and Doses.—Fluid extract, ʒ ij.-iv. per day. Soft extract, gr. ivss.-ix. per day.

Salol.—Synonym: Salicylate of phenol.

Preparation.—By heating salicylate of sodium and phenate of sodium with perchloride of phosphorus. The reaction results in the formation of salol and of secondary products, notably chloride of sodium and phosphoric anhydride. The product of the operation is treated with water which takes up the chloride of sodium and the phosphoric anhydride and leaves the salol which is purified by repeated crystallization from alcohol.

Description.—Salol should be colorless and tasteless. It is a substance of neutral reaction, soluble in alcohol and insoluble in water.

Physical Properties.—The pancreatic juice in the system decomposes salol into its two components which can be recovered from the urine.

Therapeutical Properties.—Antiseptic and antipyretic, recommended by N. Nencki and Salhi. It contains 38% of phenol,

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and does not derange the stomach. It is used in septic affections of the intestines and forms a substitute for salicylate of sodium in rheumatism.

Use and Doses.— ℈ iv. to ʒ iss. per day. Internally, in wafers of gr. iij., two to five per day.

Sanguinaria.—Synonyms: Sanguinaria canadensis L., blood-root.

Description.—A plant belonging to the Order of Papaveraceæ, indigenous to North America.

Composition.—Sanguinarine, an alkaloid, is the chief active principle.

Therapeutical Properties.—Stimulant tonic in small doses; in large doses it acts as an energetic sedative; it calms the pulse and facilitates expectoration; in excessive doses it causes vomiting.

It acts powerfully on the liver and is indicated in typhoid fever.

Doses.—Powdered root, gr. x.-lx. Sanguinarine alkaloid, gr. $\frac{1}{12}$–$\frac{1}{4}$.

Saraca indica L.—Synonym: Azok.

Description.—A plant belonging to the Order of Leguminosæ, indigenous to India.

Therapeutical Properties.—The bark is much used in uterine affections, chiefly in metrorrhagia.

Use.—Decoction, 4 parts of the bark in 8 parts of water.

Sarcostemma viminale Br.—Description.—A plant belonging to the Order of Asclepiadaceæ, indigenous to India.

Therapeutical Properties.—The sap of this plant has the property of overcoming irritation of the eyes. It sets up a substitutive and curative inflammation antagonistic to that produced by other plants.

Sarracenia purpurea L.—Synonym: Side-saddle flower, Pitcher-plant.

Description.—A plant belonging to the Order of Nymphæaceæ, indigenous to the North American marshes, Newfoundland, Saint-Pierre, and Miquelon.

Therapeutical Properties.—The Indians consider it a true specific for variola and attribute to it the power of preventing the pitting following that disease.

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Diaphoretic and diuretic. It is chiefly given in gout and dyspepsia; it stimulates the stomach and the heart.

Use and Doses.—Powdered rhizomes, gr. xxx.-xlv. per day. Fluid extract, gtt. xx.-xxx. Infusion made from the powder, in doses of one or two teaspoonfuls; the sediment to be taken with the fluid.

Schinus molle L.—Description.—A plant belonging to the Order of Terebinthaceæ-Anacardiaceæ, indigenous to Chili, Peru, and Algeria.

The fruits contain an oil which resembles Venice turpentine in appearance.

Therapeutical Properties.—The resin, called Peruvian mastic, possesses purgative properties. The dried and powdered fruit is used like cubebs.

Scopolia japonica Max.—Synonyms: Scopolia lucida, Japanese belladonna.

Description.—A plant belonging to the Order of Solanaceæ, indigenous to Nepaul and Japan.

Composition.—Professor Eykmann extracted an alkaloid from the root which he called scopoline.

Professor Schmidt, of Marburg, denies the existence of this alkaloid which is said to be merely a mixture in various proportions of atropine, hyoscyamine, and hyoscine; the state of development of the plant and the time of collection having an influence on the respective quantities of these alkaloids. He is inclined to believe that under certain conditions these three alkaloids may be converted into each other in the plant, and as bearing upon this fact he recalls Ladenburg's statement that, after combining tropic acid and tropine derived from the decomposition of hyoscyamine, we obtain, not the original alkaloid, but its isomer atropine. He also disputes the existence of a second alkaloid, rotoine, which is said to be nothing but a combination of an alkali with a fatty acid rich in carbon, a true soap which should be blotted from the list of alkaloids.

Therapeutical Properties.—Used like belladonna; employed in Japan in corneal ulcers, iritis, and keratitis.

Scutellaria lateriflora L.—Description.—A plant belonging to the Order of Labiatæ, indigenous to the United States.

Therapeutical Properties.—When the alcoholic tincture is

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precipitated with alum water, a "resinoid" is obtained ["scutellarin"] which is a tonic of the nervous system.

Doses.—Gr. ij.-iv.

Senecio canicida.—Synonyms: Yerba de la puebla.

Description.—A plant belonging to the Order of Compositæ, indigenous to Mexico.

Physiological Properties.—The active principle is very abundant in the root, but scarce in the leaves. It is a violent poison, mainly if injected. Debierre states that it relaxes the sphincters of the bladder and rectum, and excites the muscles of the intestines, bladder, and iris. Death is caused by the arrest of the respiration and convulsions, as in strychnine poisoning, though the reflex excitability is the reverse of that of strychnine.

Therapeutical Properties.—Used as a sudorific, and locally in scabies and other skin diseases; also in pharyngeal ulcerations.

Sethia acuminata Arn.—Description.—A plant belonging to the Order of Erythroxylaceæ, indigenous to Ceylon.

Composition.—Contains sethine.

Part Employed.—The leaves.

Therapeutical Properties.—A good vermifuge for children, free from narcotic effects.

Use and Doses.—Powdered leaves, gr. ix.-xi. Fluid extract, ♏ viij.-xij.

Sida floribunda H. B. K.—Description.—A shrub belonging to the Order of Malvaceæ, indigenous to Peru.

Therapeutical Properties.—Vermifuge, acting mechanically by reason of the numerous hairs which cover all parts of the plant.

Siegesbeckia orientalis L.—Synonym: Divine herb.

Description.—A plant belonging to the Order of Compositæ-Synantherеæ, indigenous to Persia, Japan, and the island of Mauritius.

Composition.—Contains an alkaloid, darutyne (Auffray) [?].

Therapeutical Properties.—Alterative, energetic depurative, very efficacious in the treatment of eruptions and ulcers; used internally as an antisyphilitic and for affections of the

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genito-urinary organs; externally in herpes circinatus and favus; it is also a sudorific.

Use and Doses.—Aqueous extract, gr. ix. in syrup. Tincture (1:8), ʒ i.–ij.

Simaba Cedron Pl.—Description.—A tree belonging to the Order of Rutaceæ, indigenous to Venezuela, New Granada, and Brazil.

Composition.—Contains an alkaloid, cedrine (Levy).

Therapeutical Properties.—Tonic, antispasmodic, antiperiodic, and febrifuge, used in malaria and dyspepsia. Given as an antidote to the bites of serpents. Saffray, of New Granada, and Bousseau, of France, have effected cures with it in desperate cases.

Use and Doses.—As an antidote, one powdered nut in fl. ℥ ij. of white wine, to be taken at a dose, with the sediment. External use, the wound to be washed with a macerate of one nut in fl. ʒ iij. of alcohol. Fluid extract, ♏ iv.–xvi., every four hours as a febrifuge. Powdered seeds, gr. iij.–xxiv.

Simulo.—Description.—A plant belonging to the Order of Capparidaceæ, according to Hale White, Capparis coriacea, and according to others, Capparis oleoides. It is indigenous to Peru and Bolivia. The fruit is a berry, resembling a currant.

Therapeutical Properties.—This plant possesses antiscorbutic and stimulant properties. It is especially antispasmodic and antinervous, with some hypnotic power. Hale White has obtained good results, but no cure, in epilepsy; Larrea and V. Poulet claim success in epilepsy and especially in obstinate hysteria.

It is a good substitute for the bromides in cases in which they are not well borne or otherwise contra-indicated.

Use and Doses.—Tincture (1:8), fl. ʒ ss.–ij. Fluid extract, fl. ʒ iiss.–iv.

Smilax Japicanga.—Description.—A plant belonging to the Order of Liliaceæ, Tribe Smilaceæ, indigenous to Brazil.

Therapeutical Properties.—Has the same properties and uses as sarsaparilla.

Soja hispida.—Description.—A plant belonging to the

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Order of Leguminosæ, indigenous to Japan and acclimated in Austria.

Therapeutical Properties.—Used as an aliment in Japan and Austria. Recommended by Lecerf for the alimentation of diabetics, as the seed contains no starch.

Use.—Lecerf manufactures bread, cakes, and biscuits for the use of diabetics.

Solanine.—Description.—An alkaloid discovered by Desfosses in the berries of Solanum nigrum, and in the leaves and berries of a large number of other Solanaceæ. It crystallizes in a solution of warm alcohol. Its taste is bitter, acrid, and nauseating, with a persistent after-taste; insoluble in water, slightly soluble in alcohol and ether, but more soluble in warm alcohol.

Therapeutical Properties.—It possesses some anæsthetic action on the extremities of the pulmonary plexus, diminishes the sensibility of the bronchial mucosa, and retards the respiration; it first moderates the pulse, and subsequently accelerates it; it irritates the stomach. In large doses it causes vomiting, colic, and constipation; in small doses it is a laxative. It has been used in sciatica, neuralgia, rheumatism, gout, cystitis, cardiac asthma, bronchitis, whooping cough and other spasmodic affections, gastric pains, dyspepsia, and prurigo.

Use and Doses.—Subcutaneous injections, three times a day, of an aqueous solution of hydrochlorate of solanine, in doses of gr. $\frac{1}{4}$–$\frac{1}{2}$.

Somnal.—Synonym: Ethyl-chloral-urethane. It was discovered [?] and first used by Radlauer.

[It is probably nothing more than an alcoholic solution of chloral and urethane.]

Description.—Commercial somnal is a colorless liquid with a slightly bitter taste which dissolves readily in alcohol and water. In vacuo it boils at about 293° F.

Therapeutical Properties.—Somnal manifests its effects half an hour after ingestion and induces tranquil sleep for from six to eight hours. It appears to have no influence on the digestion, circulation, or respiration; it seems to combine the properties of chloral with those of urethane.

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Use and Doses.—In doses of ♏ xxxij., in a draught sweetened either with licorice juice or raspberry syrup.

Somnal, ...	fl. ʒ iiss.
Water, ...	fl. ℥ iss.
Syrup, ...	fl. ℥ ss.

One tablespoonful to be taken at night.

Soymida febrifuga A. Juss.—Synonym: Swietenia febrifuga Roxb.

Description.—A tree belonging to the Order of Meliaceæ, indigenous to India.

Composition.—Contains a bitter resin, tannin, and starch.

Therapeutical Properties.—Astringent tonic and antiperiodic, in intermittent fevers, debility, diarrhœa, dysentery, gangrene, typhoid fever, infectious diseases, and cachexia.

Use and Doses.—Powdered bark, gr. xlv., twice a day. Decoction of ℥ iiss. of the bark in O i. of water, for gargles, injections, and enemata.

Sozoiodol.—Synonym: Diiodoparaphenylsulphuric acid.

Preparation.—It is prepared by treating di-iodobenzol with fuming sulphuric acid, saturating with carbonate of lead, filtering, and decomposing the lead salt with sulphuretted hydrogen, and evaporating the watery solution, from which it crystallizes. It contains 42% of iodine.

Description.—Its chemical composition permits it to combine with almost all metals. The combinations with sodium, aluminum, magnesium, lead, and zinc readily dissolve in water and glycerin, while the potassium, ammonium, barium, mercury, and silver salts dissolve with difficulty.

Therapeutical Properties.—It is a powerful antiseptic, an odorless substitute for iodoform. It excels iodoform by its rapid action in tubercular and scrofulous ulcerations, and in affections of the generative organs such as gonorrhœa and syphilis. The salts of sozoiodol have also given excellent results in inveterate skin diseases, chronic nasal catarrh, ozæna, and laryngitis. As antiseptics they are very useful in surgery, by accelerating recovery without causing untoward accidents, whether they be used pure or mixed with starch, vaselin, or lard.

Sparteine.—Description.—The alkaloid of broom, Spartium

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scoparium. An oily, bitter liquid, insoluble in water; forms with sulphuric acid a crystallizable salt which is soluble in water.

Therapeutical Properties.—See Sulphate of Sparteine.

Use and Doses.—Potion, gr. ½ in fl. ʒ ss. of syrup, three or four times a day. Pills of gr. ¼, two to ten times a day.

Spigelia marilandica L.—Synonyms: Pinkroot, wormgrass.

Description.—A plant belonging to the Order of Loganiaceæ.

Composition.—Contains a bitter, non-crystallizable principle to which the plant owes its properties; besides a volatile oil, tannic acid, etc. The active principle is a volatile alkaloid, spigeline.

Therapeutical Properties.—The root is used chiefly as vermifuge for ascarides.

Use and Doses.—It must be used with care, as it is an acrid poison. Fluid extract, gtt. xv.–xx., three or four times a day for children, and ♏ xlviij.–c. for adults.

Spiræa Filipendula L.—Description.—A plant belonging to the Order of Rosaceæ, indigenous to Europe.

Therapeutical Properties.—Roots are astringent, analeptic, and diuretic, administered in light diarrhœa.

Recommended as a remedy for rabies by Jazell, who has used it with complete success [?] in 28 cases.

Stillingia sylvatica L.—Synonym: Queen's root.

Description.—A plant belonging to the Order of Euphorbiaceæ, indigenous to the United States.

Composition.—The active principle is not known with certainty.

Therapeutical Properties.—Used in scrofula, syphilis, leucorrhœa, cutaneous affections, incontinence of urine, rheumatism, and bronchitis; the plant acts as an alterative, resolvent, stimulant, tonic, and diuretic. In large doses it is emetocathartic.

Use and Doses.—Powdered root, gr. xv.–xxx. Decoction (ʒ i. in O i. of water), fl. ʒ i.–ij. Fluid extract, gtt. xv.–lx. Tincture (1:2), fl. ʒ i.

Strophanthus.—Description.—A climbing plant, belonging

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to the Order of Apocynaceæ, indigenous to Guinea, the Senegal, the Gaboon, and the heart of Africa.

The stalk, whose thickness varies from two to five and a half inches in diameter, lies on the ground in coils which give it the appearance of a long boa constrictor. The branches, being too weak to support themselves, cling to the trunks of the nearest larger trees; when young they look something like elder bushes. The fruits grow in horizontal groups of two; they resemble two spines joined to the same branch at their point of contact; they commence to ripen in July and persist until the end of September, when they attain their perfect development by the heat of the sun associated with dryness.

To judge from the small number of plants which have been raised by artificial culture, strophanthus is of robust growth. The natives do not know what age it attains, and the knowledge of the time when it commences to bear fruit does not suffice to determine this point.

They use it for preparing an arrow poison (kombé). The seeds having been denuded of their filaments, they are triturated in a mortar until reduced to a pulp. To this is added a little water expressed from a maceration of the bark of some Liliacea. This is done to render the kombé more adhesive and prevent its detachment from the arrow in case it should strike the bone of an animal. The poison is spread on the projectile for a distance of six inches. Game hit by an arrow poisoned with kombé dies almost instantly, and is rarely able to run for a hundred yards [?]. The meat may be eaten without any inconvenience. The only precaution needed is to express into the wound the sap of a baobab twig which is said to destroy any ill effects which might result from the absorption of the poison left by the arrow [?].

Several varieties have been described by Blondel: 1, Strophanthus hispidus D. C. (Guinea and Senegal); 2, Strophanthus niger; 3, Strophanthus Kombé (central Africa); 4, Strophanthus glabrus (Gaboon).

Composition.—Hardy and N. Gallois have discovered in the tuft of the seeds a glucoside, strophanthin, which acts on the heart.

Catillon has prepared strophanthin in a crystalline form. Strophanthin is a well-characterized glucoside; gr. ¼, after di-

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gestion in 1% hydrochloric acid, reduces fl. 3 ij. of Fehling's solution; strophanthin which has not been subjected to the action of hydrochloric acid causes no decoloration. It is a neutral substance which gives a white precipitate with tannin, soluble in an excess of strophanthin; moreover, it remains indifferent in the presence of all alkaloidal reagents. Sulphuric acid produces with strophanthin a greenish precipitate which appears slowly, often only at the end of several hours. The dry crystals dissolve in three or four times their weight of hot absolute alcohol, in thirteen times their weight of cold absolute alcohol, and in no less than thirty parts of water.

Arnaud has isolated strophanthin (kombé) by exhausting the seeds with 70% alcohol, and after evaporation of the alcohol and filtration, treating with acetate of lead and litharge with heat. After cooling, purified hydrogen sulphide is passed through, the liquor is filtered and evaporated at 122° F. to the consistence of syrup; the next day strophanthin has crystallized.

Catillon and Arnaud have demonstrated that Strophanthus glabrus contains 45 to 50 parts of strophanthin per thousand, while Strophanthus Kombé only furnishes 4.5 to 5 parts.

Arnaud has shown that the two strophanthins are different bodies. Strophanthin from S. Kombé crystallizes in needles and deflects the plane of polarization to the right; that from S. glabrus appears in the form of handsome flattened, rectangular tablets, and deflects polarized light to the left. It is identical with ouabain (which see).

Fraser likewise has differentiated strophanthin from S. hispidus from the two others mentioned above.

Therapeutical Properties.—Fraser employs the tincture from the seeds; it possesses properties analogous to those of digitalis, accelerating the movements of the heart; besides, it has the advantage of not contracting the arterioles.

Dujardin-Beaumetz was able to demonstrate in a series of cases of heart disease that it is an excellent heart tonic, as active as digitalis and a true diuretic. He made use of a tincture (1:5) which he called the French tincture, to distinguish it from the English; he administered it at first in doses of gtt. vi. and gradually carried it up to gtt. xiv. and xvi. per day.

Bucquoy begins with gr. $\frac{1}{64}$ of the extract of strophanthus

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or gtt. v. of the tincture, which amounts to the same thing. He gives the tincture in syrup of bitter orange peel which suffices to mask its excessive bitterness; he has obtained marked physiological effects, particularly in heart fatigue rather than in asystoly. The diuresis differs from that produced by digitalis, but is no less energetic.

Use and Doses.—The tincture is used under various titles, also the hydro-alcoholic extract, and the glucoside in granules.

Fraser prepares the tincture from one part of the seeds and eight parts of strong alcohol.

Martindale uses one part of the seeds and twenty parts of alcohol.

Helbing's formula seems to be the best and should be followed in order to obtain a uniform product, as follows: Dry the seeds at 113° F., rejecting the seed tufts and coats; powder and extract the oil with ether; again dry the residue and prepare the tincture by maceration of one part in twenty parts of 90% alcohol.

The tincture is given in doses of gtt. v.–xx., twice a day, alone or in cherry-laurel water. The tincture is very bitter and of a light yellowish color.

Catillon prefers the hydro-alcoholic extract in granules of gr. $\frac{1}{64}$, one or two per day.

Strophanthin being so active that its toxic power is gr. $\frac{1}{130}$ per pound of the animal's weight, it must be used with care. The ordinary dose is one granule of $\frac{1}{600}$ of a grain; maximum dose, gr. $\frac{1}{130}$.

Subiodide of Bismuth.—Preparation.—C. Mayo prepares it by triturating 306 parts of subnitrate of bismuth with 165.6 parts of iodide of potassium, and sufficient hydrochloric acid to form a paste. The mixture becomes yellow and is then thrown into water, where the reaction is completed.

England proposes to dissolve the subnitrate of bismuth in nitric acid, to dilute it with warm water, and to pour this solution little by little into another warm solution of iodide of potassium, under continual stirring. When the decomposition is complete, the precipitate is collected on a filter, washed, and dried.

Description.—The salt appears as a heavy precipitate, coherent, of a brick-red color, having the composition BiOI or

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$BiOI,H_2O$, insoluble in water, alcohol, ether, and chloroform, and is decomposed by strong mineral acids and by alkalies.

Therapeutical Properties.—Used in the United States as an application to indolent ulcers and as a general substitute for iodoform, since it possesses the same properties and has the advantage of being inodorous.

Use.—The drug is applied locally, by being dusted over the affected part.

Succinimide of Mercury.—Preparation.—Succinimide is first prepared by making ammonia gas react upon anhydrous succinic acid, or by rapid distillation of succinate of ammonium. The succinimide combines in concentrated hot solution with oxide of mercury, and on cooling deposits succinimide of mercury. Formula, $(C_4H_4O_2N)_2Hg$.

Description.—Long, silky, colorless needles, very soluble in water, fairly soluble in alcohol.

Therapeutical Properties.—Antisyphilitic, recommended for hypodermic injection because it does not precipitate albumin.

Use and Doses.—Hypodermic solution:

Succinimide of mercury,. . . .	gr. xxiv.
Distilled water, ...	O ij.

In doses of one syringeful. To moderate the smarting, gr. ½ of cocaine is added to each syringeful.

Sucupira.—Synonym: Bowditchia major.

Description.—A tree belonging to the Order of Leguminosæ-Papilionaceæ, Tribe Sophoreæ, indigenous to Brazil.

Part Employed.—The bark.

Composition.—H. Petit has extracted a well-defined alkaloid from the bark.

Therapeutical Properties.—The alkaloid is stupefying and mydriatic. The bark is used in gouty and rheumatic affections; it is regarded as depurative, febrifuge, and useful in all forms of arthritic disease.

Sulphaminol.—Preparation.—That of thiooxydiphenylamine, obtained by the action of sulphur on salts of methaoxydiphenylamine.

Description.—The product is a yellowish, odorless, taste-

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less powder, insoluble in water, easily dissolved by alkalies, less readily by alkaline carbonates, also soluble in alcohol and crystallizable acetic acid. It is turned brown by heat, melts at 311° F., and forms pale yellow solutions; it is decomposed in the system where it produces the effects peculiar to sulphur and phenol.

Physiological Properties.—According to Kobert, sulphaminol may be administered in massive doses to a dog without seriously deranging the appetite.

Therapeutical Properties.—Moritz states that, like iodoform, it diminishes abundant suppuration, with the advantage of being odorless. It possesses very powerful antiseptic properties.

Sulphate of Sparteine.—Physiological Properties.—Its physiological properties have been tested by Laborde.

Therapeutical Properties.—It produces remarkable effects on the heart, without interfering with digestion or the nervous system. According to Germain Sée, it accelerates the heart and pulse and in this respect resembles digitalis and lily of the valley, but its effects are more prompt and lasting.

Use and Doses.—$\frac{1}{4}$ to 4 grains.

Sulphonal.—Synonym: Diethylsulphondimethylmethane.

Preparation.—It is the product of the combination of ethylmercaptan and acetone.

Description.—A white, crystalline substance, almost insoluble in water (1:240 to 1:250 in the cold; 1:18 to 1:20 at 212° F.); soluble in alcohol, ether and chloroform; melts at 266° F., boils at 572° F. It is not attacked by acids nor by the most energetic alkalies; it has neither taste nor odor.

Physiological Properties.—C. Paul has convinced himself by experiment that in the system during digestion the presence of salts and peptones favors the solution and absorption of sulphonal; while the latter has no influence on the action of the salivary, gastric, pancreatic, or intestinal juices which is impeded by chloral and paraldehyde.

Hénocque has studied the action of sulphonal on Guinea-pigs and has demonstrated that it does not hinder the formation of oxyhæmoglobin. In animals killed by poisonous doses of sulphonal, even the venous blood is of a bright red color, more vivid than in intoxication by carbonic oxide or prussic

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acid. This phenomenon is characteristic of death by arrest of metabolism.

Hence sulphonal is not, properly speaking, a blood poison; it suspends the vital changes within the tissues, lowers the temperature, and leads to a general state which is somewhat analogous to that in hibernating animals.

C. Paul has employed sulphonal in a large number of cases and has demonstrated, in the first place, its absolute innocuousness as regards the heart and respiration, as, for instance, in a case of enormous hypertrophy of the heart; in two cases only has a slight and temporary rubeolic eruption been observed.

Therapeutical Properties.—The cases in which sulphonal is indicated are those of simple nervous insomnia, that is to say, those in which it is not due to pain from an organic lesion; the latter, therefore, should be treated first; besides, it has succeeded in cases of insomnia caused by toothache or facial neuralgia.

In delirium tremens sulphonal has given indifferent results; in apoplexy, gr. xlv. of sulphonal succeeded where ʒvss. of chloral had failed; it proved equally useful in insanity with delirium and in morphiomania. In nervous insomnia C. Paul obtained 30 successful results in 30 cases; he prescribes gr. xv. to ʒ i. of sulphonal for adults, in warm soup, milk, or better in wafers, even in the course of digestion which is not interfered with; he never observed insomnia on the following day; on the contrary, the power to sleep returns so that sulphonal need be given only every other day. It is essential that the sulphonal be absolutely pure, that is to say, be free from taste and odor.

Huchard gave sulphonal to 15 patients, but was not satisfied with it.

Its effects are elicited very slowly; the sleep is heavy, the somnolence, with a variable degree of intoxication and hebetude, persists on awaking and during the following day; it is efficacious in cases of insomnia due to cough in phthisis, in cardiac affections, neuralgias, and grave fevers.

It is most effective in nervous insomnia, but the impression of lassitude, as well as the tendency to staggering, cerebellar rather than ataxic, which it leaves behind, show that it can be proposed in place of chloral only with some reservation.

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Inconveniences.—Although sulphonal procures a quiet sleep in a large number of patients, its use may lead to some more or less serious troubles—paresis, ataxic movements, dulling of the intelligence, loss of appetite, frequent and painful vomiting, with nausea.

These are among the drawbacks observed by Marandon de Montyel from the use of sulphonal among the insane. He has used it in about 80 cases and in 14 it has caused some of the symptoms of intolerance or intoxication cited above.

Doses.—Daily dose, gr. xxx., in wafers of gr. xv., morning and evening.

Sulphoricinoleic Acid.—Synonyms: Polysolve, solvin, sulpholein.

Preparation.—Mix 2½ lbs. of pure castor oil with fl. ℥ v. of pure sulphuric acid of 66° at a low temperature under constant stirring, to avoid a rise in temperature. But very little sulphurous acid is disengaged. After one hour's contact, it is washed with cold water, the superior aqueous layer drawn off, and the remainder again washed several times with 10% saline water; soda is added until the reaction is but slightly acid; after standing at rest it is decanted and filtered.

Description.—The product, which has the consistence of a thick syrup, can dissolve 10% of naphthol or creosote, 15% of salol, 40% of phenol; these solutions require the application of a moderate degree of heat.

Sulphoricinoleic acid also dissolves alizarin, chrysophanic acid, cantharidin, and camphor; it mixes with ether, chloroform, bisulphide of carbon, benzin, terpinol, and volatile oils (Berlioz and Ruault).

Use.—Mixed with water, these solutions form emulsions which are sufficiently stable to be used in medical practice.

Sulphovinate of Quinine (*basic*).—Formula, $(C_{20}H_{24}N_2O_2.C_2H_5)_2SO_4$.

Preparation.—Take ℥ iiss. of sulphate of quinine and dilute it with a small quantity of water in a mortar until it is well divided in the liquid. Make a hot solution of ℈ iv. of sulphovinate of barium in about fl. oz. v. of water. Pour the sulphate of quinine solution gradually into the barium solution under continual stirring. After the lapse of some time filter in order to separate the deposit of sulphate of barium which

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results from the double decomposition, and after ascertaining that no traces of the barium salt remain, evaporate the liquor on a water bath. The desiccation is completed under a bell glass in presence of fused chloride of calcium. ʒ ij. of the salt are obtained.

Description.—This salt appears in the form of a white, crystalline mass. It contains almost the same proportion of alkaloid as the basic sulphate, that is to say, about 72% of quinine.

Sulphovinate of Quinine (neutral).—Formula, $C_{20}H_{24}N_2O_2.C_2H_5.SO_4$.

Preparation.—Precipitate bisulphate of quinine, or sulphate of quinine acidulated with a sufficient quantity of sulphuric acid, by a solution of sulphovinate of barium; proceed as above.

The salt may also be prepared by mixing an alcoholic solution of sulphate of quinine with an alcoholic solution of sulphovinate of sodium. Strong alcohol of 90% or 95% must be used in order to facilitate the separation of the sulphate of sodium. The alcohol is distilled off before crystallization.

Description.—Very soluble and readily deliquescent in moist air. It contains less quinine than the basic salt, viz. 56.25%.

Therapeutical Properties.—The injections were first employed by Constantin Paul, who demonstrated their efficiency and superiority over sulphate of quinine. Jaillard, professor at the Medical School of Algiers, has introduced these injections into Algeria, where they do much good in the treatment of paludal fevers which are so pernicious and intractable that they often resist the action of sulphate of quinine taken in the form of pills or solution.

Use and Doses.—Hypodermic injections:

Sulphovinate of quinine, ...	1 part.
Distilled water, ...	9 parts.

♏ xvi. of this solution represent gr. iss. of sulphovinate of quinine (Constantin Paul).

Sulphurous Acid.—Bacteriological Properties.—In order to disinfect a locality formerly occupied by patients affected with contagious diseases, recourse must be had to combustion of sulphur, according to Dujardin-Beaumetz.

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It was necessary to find a substance which could be handled by persons not accustomed to similar operations; the vapors of which could penetrate the bedding, while free from bad effects upon furniture and curtains.

Sulphurous acid fulfils the conditions of cheapness, facility of handling, and complete disinfection required.

After covering all crevices and joints of the windows with strips of glued paper, 3 v. of sulphur are burned for each cubic yard of the premises. The sulphur is placed on a sheet-iron plate slightly elevated above the floor; or, as Pasteur advises, a small furnace of fire-brick is used, the walls of which are perforated so as to facilitate combustion. Each of the crucibles should be capable of burning two pounds of sulphur. In order to obtain complete combustion of sulphur flour, the surface is sprinkled with alcohol and ignited. All the crevices being closed, the sulphurous vapors penetrate the entire chamber. Test papers carefully inclosed in the interior of mattresses or in boxes are acted on by the gas.

This procedure is the cheapest and simplest. Culture liquids experimented on were sterilized, excepting tubes inclosing the bacteria of anthrax; the properties of vaccine virus were destroyed.

Objects of copper or iron are protected by being covered with grease.

The method of burning bisulphide of carbon is intermediate between Pictet's method and that of burning sulphur, but it requires the use of a special expensive burner devised by Chiandi.

Lastly, the sulphuretted tapers invented by Deschiens are of great service in regulating the quantity of gas disengaged in a certain time.

Sulphydric Acid.—Synonym: Sulphuretted hydrogen.

Therapeutical Properties.—This gas, though deleterious, still finds therapeutical application. It has been proposed in the treatment of affections of the respiratory passages, especially tuberculosis. This treatment is said to arrest pulmonary suppuration, diminish expectoration, reduce the fever and the sweats, and restore rest and appetite.

Arnozan and Ferré state that it should be administered with reserve, since it abolishes the glycogenic function of the liver.

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Use.—On the advice of Claude Bernard, Bergeon, of Lyons, recommended rectal injections of the gas. Bardet has devised an injector of convenient form.

Subcutaneous injections of liquid medicinal vaseline saturated with sulphydric acid. ♏ xviij. of the injection contain four times that volume of the gas (Bocquillon).

Symphoricarpos vulgaris.—Synonym: Snowberry.

Description.—A plant belonging to the Order of Caprifoliaceæ, indigenous to North America.

Part Employed.—The leaves from young shoots.

Therapeutical Properties.—Febrifuge and astringent, used in ulcers and menorrhagia. Recommended by Newton as an alterative and diuretic.

Use and Doses.—Powdered leaves, gr. xv., two or three times a day. Tincture (1:5), ʒ ss.–i.

Syzygium jambolanum D. C.—Synonyms: Jambol or jambul.

Description.—A plant belonging to the Order of Myrtaceæ, indigenous to India.

Composition.—Gerrard has extracted from it a crystalline substance which he calls jambosine and to which he assigns the formula, $C_{10}H_{15}NO_3$ [?].

White crystals, having no taste, melting at 170.6° F.; soluble in ether, alcohol, and chloroform, insoluble in cold water, slightly soluble in hot water.

Part Employed.—The envelope of the fruit and the bark.

Therapeutical Properties.—The sap expressed from the leaves is antidysenteric.

Baneha recommends this drug in the treatment of diabetes; the sugar disappears after forty-eight hours, and while the drug is used starchy food may be taken with impunity. It is stomachic, carminative, and astringent. Scott maintains that its presence in the stomach retards and diminishes the sugar-producing action of the saliva and the pancreatic juice.

In India the fruit and the bark are used as astringents in dysentery, blennorrhagia, and leucorrhœa.

Use and Doses.—Powdered fruit, gr. ivss., three times a day, in wafers. Capsules containing gr. ij. of the powder.

Tabernæmontana neriifolia L.—Description.—A plant

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belonging to the Order of Apocynaceæ, indigenous to Porto Rico.

Therapeutical Properties.—A decoction of the bark is a powerful remedy for indolent ulcers. In Porto Rico the inhabitants use it in syphilis and intermittent fevers.

Tanghinine.—An alkaloid extracted from Tanghinia venenifera Don., a plant belonging to the Order of Apocynaceæ, indigenous to Madagascar.

Preparation.—It is prepared from the kernel of the fruit.

From about 27 lbs. of the nuts Arnaud obtained about 6 lbs. of kernels, from which he endeavored to extract the active principle. The kernels, deprived of fatty matter (75%) by bisulphide of carbon, furnished an alcoholic extract from which he obtained nearly an ounce of a crystalline substance which he called tanghinine.

Description.—This substance is soluble in 200 parts of water, very soluble in alcohol and ether, and deflects a beam of polarized light to the left. In presence of water it swells and furnishes a thick and tenacious mucilage.

Composition.—Dilute acids separate from it a yellowish, amorphous, resinous body which does not reduce sugar.

Hence it is not, like strophanthin and ouabain, extracted from related Apocynaceæ, a true glucoside; nor is it an alkaloid, for it contains no nitrogen.

Physiological Properties.—Its physiological action approaches that of strophanthin and ouabain; it is in fact a cardiac poison, with this difference that it causes general convulsions.

Tayuya.—Synonym: Trianosperma ficifolia Mart.

Description.—A climbing plant belonging to the Order of Cucurbitaceæ, indigenous to Brazil, Paraguay, and La Plata.

Part Employed.—The root.

Composition.—Contains an alkaloid, trianospermine, and a resin, tayuyin (Yvon).

Therapeutical Properties.—The active principles of the root are used in grave cases of dropsy, paralysis, intractable cutaneous affections, and the tertiary manifestations of syphilis.

Use and Doses.—Powdered root, ʒ i. Decoction or infusion, ♏ ij.–vi. Tincture, gtt. vi.–xv.

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Terebene.—Preparation.—A polymerized form of spirit of turpentine, produced by the action of sulphuric acid on spirit of turpentine, followed by distillation.

Description.—A complex body, having the pleasant odor of freshly sawed pine wood; insoluble in water.

Therapeutical Properties.—An agreeable and odorless antiseptic and disinfectant. The vapor of terebene is sedative and antiseptic, used in phthisis.

Internally it is given in capsules for intestinal antisepsis and in dysentery. Sedative and antiseptic for the bladder and the urinary passages.

Use and Doses.—Given by inhalation with boiling water or by the stomach in the form of lozenges·

Terebene,	fl. ℥ ss.
Powdered gum acacia,	ʒ iij.
Water,	fl. ℥ ij.
Powdered sugar,	℥ vi.
Powdered gum tragacanth,	ʒ ij.

To make 100 lozenges.

Emulsion:

Terebene,	fl. ℥ ss.
Powdered gum acacia,	ʒ iij.
Water,	fl. ℥ ij.
Syrup of ginger,	fl. ℥ i.

Put into capsules of ♏ iv. each.

Doses.—♏ iv. to ♏ xxiv. per day.

Terpin, Terpinol.—Terpin is the crystalline hydrate of spirit of turpentine.

Preparation.—It is prepared by placing in contact 4 parts of spirit of turpentine, 3 volumes of alcohol, and 1 part of nitric acid. After several weeks beautiful crystals are obtained.

In presence of sulphuric or hydrochloric acid, terpin is transformed into an oily substance, terpinol.

Therapeutical Properties.—Terpin and terpinol have been recommended as balsamics, to be substituted for copaiba in catarrhal affections of the respiratory passages. Lepine, of Lyons, thinks that terpin may be substituted for turpentine as an expectorant and diuretic; he gives it in doses of gr. iij.–ix.

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Under the influence of terpinol the sputa of chronic bronchial catarrh become fluid, lose their disagreeable odor, and are easily expectorated.

Use and Doses.—Potion, as follows:

Terpin, ...	gr. xxx.
Glycerin, ...	fl. ℥ iss.
Alcohol, 90%, ...	fl. ℥ ii.¼

Two spoonfuls per day. Pills, four or five in twenty-four hours. Capsules of gr. iss. Wafers. The comparative insolubility of terpin induced Dujardin-Beaumetz to give terpinol in capsules of ♏ ij., six to twelve per day, or pills in the same quantity, according to the following formula:

Terpinol, ...	♏ xviij.
Benzoate of sodium, ...	gr. xv.
Sugar, ...	q. s.

Tetrachloride of Carbon.—Synonym: Perchlorated chloride of methyl. CCl_4.

Preparation.—A current of chlorine and bisulphide of carbon is passed through a porcelain tube heated to redness. The liquid formed is agitated with a solution of potassa, and then distilled.

Description.—A colorless, mobile liquid, of an ethereal odor, insoluble in water, soluble in alcohol and ether. It boils at 172.4° F.

Therapeutical Properties.—Used as an anæsthetic which acts rapidly and is free from danger, though it is less active than chloroform. Given in dysmenorrhœa, hay fever, tic douloureux, and neuralgia.

Use.—By inhalation from a handkerchief, like chloroform. Externally, in frictions with a piece of flannel saturated with the liquid.

Thalline.—A substance discovered by Skraup, of Vienna.

Preparation.—It is derived from quinoline; the chemical change being from paraoxyquinoline or paraquinanisol to tetrahydroparaquinanisol or thalline, C_9H_6,H_4N,OCH_3.

It is obtained by heating to 284° F. para-amidoanisol with paratrinitroanisol in presence of sulphuric acid and glycerin.

Description.—An oily liquid; it assumes an emerald green

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color with perchloride of iron; it forms salts with acids, those known being, the sulphate, the tartrate, and the hydrochlorate.

Physical Properties.—These salts in concentrated solutions are bitter, saline, and pungent; in dilute solutions they have an aromatic and agreeable taste. The sulphate is soluble in five times its weight of water, and the tartrate, in ten times its weight of water.

Bacteriological Properties.—The salts possess antiputrid properties, for they retard ammoniacal and alcoholic fermentation and the fermentation and decomposition of milk (Huchard).

Therapeutical Properties.—The sulphate is the most active. It is used for urethral injections in cystitis. It is also given internally in fevers. In nearly one hundred cases of fever due to different morbid conditions (intermittent fever, typhoid fever, rheumatism, rubeola, erysipelas, febrile puerperal state, pneumonia, and tuberculosis) Jacksch succeeded in reducing the temperature to the normal, without any untoward accidents.

In intermittent fever, after the first attacks are suppressed by the administration of thalline two or three hours before their onset, even though their intensity and duration are diminished by the drug, it is still necessary to have recourse to sulphate of quinine; hence it is an antipyretic, but not an antiperiodic. In typhoid fever and in the pyrexia of tuberculosis and rheumatism, thalline acts promptly, but has no effect on the pain nor on the duration of the rheumatism.

The salts of thalline are powerful antipyretics; the fall of temperature is followed by profuse perspiration. After the administration of gr. iv. of the salts, the temperature is lowered 2.2°. If the evening temperature rises to 102.8° and gr. viij. of one of these salts be administered, the temperature will fall to 98.6° F. at the end of two hours. The secondary elevation of the temperature ensues after four or five hours and is accompanied by chills, but never by vomiting, sweats, or cyanosis, according to Huchard.

Doses.—Gr. iij.–viij.

Thevetia neriifolia Suss.—Synonym: Alelia de Matto.

Description.—A plant belonging to the Order of Apocynaceæ, indigenous to tropical America, Asia, and Java.

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Composition.—Contains a glucoside, thevetin (Blas).

Therapeutical Properties.—Used in small doses as an emeto-cathartic. The extract from the bark, prescribed in intermittent fevers in the intervals between the attacks, prevents their return and cures the chills.

Use.—Tincture (1:5), gtt. x.–xv. Extract from the bark, ℥ ij.

Thiol.—A product very similar to ichthyol, prepared by Jacobsen.

Preparation.—In the manufacture of thiol, use is made of commercial gas oil which contains, besides the saturated hydrocarbons of the fatty series, carbons of the ethylenic and acetylenic series. This product is heated on an oil bath to a temperature of about 419° F., and flour of sulphur gradually added. The sulphuration of the hydrocarbons is effected with the disengagement of sulphuretted hydrogen. According to the quantity of sulphur added, more or less of the sulphuretted hydrocarbons are obtained. The mass is then treated with concentrated sulphuric acid which produces thiosulphonic acid, and is neutralized with ammonia. This ammoniacal salt is the thiol of Jacobsen.

Description.—Soluble in water and in a mixture of alcohol and ether.

Therapeutical Properties.—It possesses the therapeutical properties of ichthyol.

Use.—Externally, in the form of an ointment 1:20. Internally, in the same way as ichthyol.

Thioresorcin.—Synonym: Bisulphydrate of phenyl. Formula, $C_6H_4(SH_2)_2$.

Preparation.—Disulphurous chloride of phenylene is heated with tin and hydrochloric acid, and then distilled with water.

Description.—A pale yellow powder, odorless, not poisonous, insoluble in water, soluble in ether and alcohol; melts at 80.6° F., boils at 469.4° F.

Therapeutical Properties.—Possesses the therapeutical properties of iodoform; its use is recommended because of its harmlessness and odorlessness.

Use and Doses.—Locally, in powder sprinkled on the wound. Ointment:

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Lard, ... 3 v.
Thioresorcin, ... 3 ss.–i.

Thymolate of Mercury.—Preparation.—A solution of nitrate or acetate of mercury is treated with an alcoholic solution of thymol, the thymolate is precipitated, collected, and dried.

Description.—A crystalline, white, odorless, and tasteless powder, soluble in dilute alcohol and almost insoluble in water.

Therapeutical Properties.—Antisyphilitic, suitable for internal use or for intramuscular injection. The injections only rarely cause smarting or infiltration.

Use and Doses.—Pills of gr. ¼ to iss. Subcutaneous injections:

Thymolate of mercury, ... gr. xv.
Liquid medicinal vaselin, ... 3 iiss.

One-half to one syringeful for each injection.

Toddalia aculeata Pers.—Synonym: Lopez root.

Description.—A plant belonging to the Order of Rutaceæ, indigenous to India and the islands of the Indian Ocean.

Therapeutical Properties.—The fresh leaves are used in abdominal pains. A powerful tonic in general debility, chronic diarrhœa, and the convalescence from grave fevers. It may be combined with ferruginous medication.

Use and Doses.—Tincture (1:5), fl. 3 iss.–vss. per day. Infusion (3 iiss. in fl. ℥ iij. of water), fl. ℥ i.–ij., two or three times a day.

Tradescantia erecta.—Synonym: Yerba del pollo.

Description.—A plant belonging to the Order of Commelinaceæ, indigenous to Mexico.

Therapeutical Properties.—A powerful astringent, used as a hæmostatic.

Traumaticin.—A solution of gutta-percha in chloroform.

Preparation.—3 iiss. of gutta-percha are placed into 2½ fl. oz. of chloroform. After twenty-four hours the gutta-percha is completely dissolved; to this solution are added 3 ivss. of chrysophanic acid.

Therapeutical Properties.—Auspitz recommends painting psoriasis cases with traumaticin containing 10% of chrysophanic acid.

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The affected spots being painted with this solution and allowed to dry, a layer of gutta-percha with chrysophanic acid is left behind which permits the patients to attend to their vocation. The medicated layer is renewed every other day. The erythematous circle is soon observed to form, and the psoriasis patches seem to disappear with great rapidity (Besnier).

Use.—May serve as a vehicle for a large number of drugs, especially chrysophanic acid in 10% strength.

Tragia volubilis L.—Description.—A plant belonging to the Order of Euphorbiaceæ, indigenous to the Antilles and South America.

Part Employed.—The root.

Therapeutical Properties.—Alterative and powerful sudorific, used in venereal diseases. The sap is applied in order to destroy ulcers.

Use.—Decoction, ʒ i. in O i. of water.

Tribulus lanuginosus L.—Synonyms: Nering's fruit, burra gokeroo.

Description.—A plant belonging to the Order of Rutaceæ, Tribe Zygophyllaceæ, indigenous to India and Cochin-China.

Therapeutical Properties.—Emollient and diuretic, antispasmodic, used in dyspnœa, colic, gonorrhœa, and irritation of the urinary passages.

Use and Doses.—Powdered fruit, ʒ iss.; water, O i., boiled down one-half. Infusion, ʒ i.–ij. in O i. of water.

Trichlorophenol.—Preparation.—Obtained by the prolonged action of chlorine on phenol until the latter congeals into a mass of crystals; these are drained and pressed dry.

Description.—Fixed needles; slightly soluble in water, soluble in glycerin, alcohol, and ether. It melts at 111° and boils at 482° F.

It combines with oxides to form salts. The salts used in practice are those of calcium and magnesium.

Therapeutical Properties.—Antiseptic, non-irritating to the tissues; may with advantage be substituted for phenol.

The solution of trichlorophenate of magnesium is used in purulent ophthalmia; recovery is assured and rapid.

Use and Doses.—A 2% solution of the magnesium salt in water, as a collyrium.

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Trinitrin.—Synonym: Nitroglycerin. $C_3H_5(NO_2)_3O_3$.

Preparation.—It is formed by carefully mixing glcyerin with fuming nitric acid. This mixture is poured into water, where the oily drops of trinitrin collect at the bottom.

Therapeutical Properties.—Huchard, Potain, and Hérard have demonstrated that the entire therapeutical action of trinitrin consists in its applicability to the cure of angina pectoris. It is a vaso-dilator agent which is useful not only in angina pectoris due to ischæmia of the cardiac muscle, but also in all affections of the aorta that produce cerebral ischæmia (regurgitation and insufficiency). Trinitrin may be given with advantage in chlorosis of great intensity, in neuralgia due to anæmia, and in some cases of hypochondriasis, because the vaso-motor derangements by their exaggeration lead to a true cerebral anæmia (Dujardin-Beaumetz).

Use and Doses.—Internally, a dilute alcoholic solution:

Trinitrin, 1% alcoholic solution, . .	gtt. xxx.
Distilled water, ...	fl. ʒ x.

One tablespoonful morning, noon, and evening.

Solution for hypodermic injection:

Trinitrin, 1% alcoholic solution, . .	gtt. xxx.
Distilled cherry-laurel water, . .	fl. ʒ iiss.

A syringe contains three drops of trinitrin. The ordinary dose is from one to three drops.

Tulipine.—Description.—An alkaloid extracted from the tulip, Tulipa vulgaris L., Order Liliaceæ, indigenous to Europe. The alkaloid was discovered by J. Gérard.

Physiological Properties.—Largely increases salivation, acts on the heart like veratrine, and on the spinal cord like colchicine and scillitine.

Therapeutical Properties.—Sialagogue and cardiac remedy.

Use and Doses.—Granules. Pills in doses of gr. $\frac{1}{64}$ to $\frac{1}{20}$ per day.

Tylophora asthmatica Wight and Arn.—Description.—A plant belonging to the Order of Asclepiadaceæ, indigenous to India.

Part Employed.—Formerly the root was used, recently the leaves have been substituted for it.

Therapeutical Properties.—This plant possesses emetic,

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diaphoretic, and expectorant properties; it may with advantage replace ipecac in dysentery. The leaves are smoked for the relief of asthma.

Use and Doses.—Powdered leaves, gr. xxiv.–xxx. as an emetic, and gr. ij.–v. as an expectorant.

Ulex diureticus L.—Synonym: Spiny furze.

Description.—A plant belonging to the Order of Leguminosæ, indigenous to Europe.

Composition.—Contains an alkaloid, ulexine, which is toxic and convulsant.

Therapeutical Properties.—The plant is an energetic but harmless diuretic.

The alkaloid produces spasms and nervous movements. It is used in paralysis and as an antidote to strychnine.

Use and Doses.—Fluid extract, gtt. x.–xx. Ulexine, gr. $\frac{1}{60}$–$\frac{1}{20}$.

Ural.—Synonyms: Uralium, chloralurethane.

Preparation.—A compound of chloral with urethane. Discovered by Bischof and studied by J. Poppi, of Bologna.

Description.—Colorless crystals of a very bitter taste.

Therapeutical Properties.—In man, doses of gr. xv.–xxx. promptly cause a quiet sleep which is followed on awaking by somnolence and general weakness which disappear but very gradually. In this prolonged effect it resembles chloral, from which it differs, however, by the greater rapidity of its action. It notably lowers the blood pressure, slightly increases the frequency of the pulse, without sensibly lowering the temperature. The sleep is sufficiently light to be easily interrupted; it suspends the cough and pain in patients whose insomnia is due to these causes. Another important fact is, that it is well borne in heart disease, even in doses of ʒ i. and over; it is, moreover, quite harmless.

Use.—Being very bitter, it should be given in strongly aromatic draughts or in wafers.

Urethane.—Synonyms: Carbamate of ethyl, carbamic ether, ethylurethane. Formula, $CO_2,NH_2C_2H_5$.

Preparation.—This substance may be prepared: 1, by the action of ammonia upon chlorocarbonate of ethyl; 2, by the action of anhydrous ammonia upon carbonate of ethyl (car-

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bonic ether); 3, by the action of alcohol upon chloride of cyanogen.

Description.—Colorless crystals, of a slightly bitter taste; very soluble in water and alcohol. It resembles saltpetre.

Physiological Properties.—Jaksch first tried urethane upon animals. Administered to man in small doses, gr. iv.–viij., it manifests its effects only slowly and after repeated doses, although its action is prompt in gr. xv. doses. It acts as a depressant of spinal irritability, retarding the pulse and the respiratory movements, diminishing peripheral and muscular irritability, and inducing in some patients true anæsthesia. Its hypnotic power is feeble. J. Gordon observed that its action was very irregular in sane subjects. The sleep, however, is calm and the awaking excellent. W. H. Flint has obtained fairly good results in nervous insomnia, though other, more energetic hypnotics such as sulphonal or paraldehyde could not be borne. But in the insomnia caused by cough or pain it failed.

Therapeutical Properties.—First studied by Schmiedeberg, then by Huchard, and lastly by J. Gordon in the most exhaustive manner, its advantages over other hypnotics are the following: absence of any secondary effects, readiness with which it is taken by the patients, and lastly, quiet sleep absolutely resembling natural slumber. It is particularly suitable for children, for cases of alcoholic delirium, and for patients subject to attacks of mania.

Its one great advantage is its perfect solubility, but its activity is not very great.

Doses.—For adults, gr. xv.–xxx., and for children, gr. viij.–xv., in a draught of fl. ʒ v. It is toxic only in large doses (ʒ iiss.).

Valerianate of Cerium.—Therapeutical Properties.—Blondeau gives it in the vomiting of pregnancy.

Doses.—Gr. iss., before the principal meal.

Vandellia diffusa L.—Synonym: Torenia diffusa H. B.

Description.—A plant belonging to the Order of Scrophulariaceæ, indigenous to India, Paraguay, and Guiana.

Part Employed.—The leaves.

Therapeutical Properties.—An excellent emetic and dras-

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tic. Given in malignant fever, dysentery, and diseases of the liver.

Use.—Infusion of a handful of the fresh leaves. Aqueous extract, in doses of gr. xv.-xxiv.

Vaselin (liquid, medicinal).—Synonyms: Vaselin oil, liquid paraffin.

History.—P. Vigier, in 1882, dissolved pilocarpine in vaselin oil.

Later, A. Meunier, of Lyons, discovered, and Dujardin-Beaumetz and Ley, of Paris, made experiments with, the therapeutic action of different substances dissolved in liquid vaselin. They found that certain drugs which had an irritant effect upon the skin lost this property when dissolved in that vehicle. Thus it became possible to inject eucalyptol, myrtol, helenol, and iodoform without danger.

H. Bocquillon, in a report to the Therapeutical Society and the Society of Practical Medicine, established the physico-chemical properties of this substance and its tests, and adapted its use to a number of medicaments.

Test.—Liquid medicinal vaselin must be neutral to test paper, have a clean taste, and not seem acid to the tongue. Its specific gravity at 59° F. is 0.875, or 76° on Gay-Lussac's alcoholometer. No vapors should be disengaged under 392° F.

Description.—Vaselin oil is not soluble in water, dilute or strong alcohol, glycerin, methylic or amylic alcohol. It dissolves in all proportions ether, chloroform, essential oils, benzin, bisulphide of carbon, sulphuretted hydrogen (four volumes at 59° F.), iodine, bromine, phosphorus, thymol, iodoform, paraldehyde, and terpinol.

Therapeutical Properties.—Liquid vaselin serves merely as a vehicle for substances which retain their therapeutical properties.

Use and Doses.—I have divided the study of liquid vaselins into four series:

1. Antiseptic injections.
2. Injections of alkaloids.
3. Mercurial injections.
4. Miscellaneous injections.

The proportions are approximated to percentages, and the doses given are the maximum of the active principle.

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A. Antiseptic Injections.

Eucalyptol, ... fl. ʒ vi.
Liquid medicinal vaselin, . . . fl. ℥ iij.

Used in tuberculosis, in doses of ♏ viij. to xx. per day.

Ecualyptol, ... 19 parts.
Iodoform, ... 1 part.
Liquid medicinal vaselin, . . . 80 parts.

Used in tuberculosis, in doses of ♏ viij.–xx. of eucalyptol and gr. ss.–i. of iodoform.

Bisulphide of carbon, ... fl. ʒ iij.
Liquid medicinal vaselin, . . . fl. ℥ iij.

Used in tuberculosis, in small quantities.

Iodoform, ... 1 part.
Liquid medicinal vaselin, . . . 90 parts.

Employed in tuberculosis and blennorrhagia, surgical disinfectant, in doses of gr. ½ to ¾.

Myrtol, ... 20 parts.
Liquid medicinal vaselin, . . . 80 "

Used in fœtid bronchitis, bronchorrhœa, cystitis, and sciatica, sometimes given in doses of ♏ xvi.

Turpentine, ... 20 parts.
Liquid medicinal vaselin, . . . 80 "

Used in bronchitis and cystitis, in doses of ♏ xvi.

Thymol, ... 10 parts.
Liquid medicinal vaselin, . . . 90 "

Used in tuberculosis and as a general disinfectant, in doses of ♏ iij.–v. per day.

Phenol, ... 1 part.
Liquid medicinal vaselin, . . . 99 parts.

Used in tuberculosis in doses of ♏ vij. per day; antiseptic.

Terpinol, ... 5 parts.
Liquid medicinal vaselin, . . . 95 "

Used in bronchitis and cystitis; dose, ♏ xvi.

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Iodine, ... 2 parts.
Liquid medicinal vaselin, . . . 98 "

Used in asthma, emphysema, uric acid diathesis, and for iodine treatment, in doses of ♏ xvi.

Menthol, ... 10 parts.
Liquid medicinal vaselin, . . . 90 "

Used as a substitute for cocaine. Is harmless.

Eugenol, ... 3 parts.
Liquid medicinal vaselin, . . . 97 "

Used in tuberculosis. Is well borne.

Helenin [elecampane camphor], . . 1 part.
Liquid medicinal vaselin, . . . 99 parts.

Used as a microbicide of Koch's bacillus.

Chloroform, ... 20 parts.
Liquid medicinal vaselin, . . . 80 "

Used for anæsthetizing microbes (!) and in sciatica and neuralgia. Is well borne.

Salol, ... 10 parts.
Chloroform, ... 10 "
Liquid medicinal vaselin, . . . 80 "

Used as an antiseptic and in sciatica.

B. Injections of Alkaloids (calculated for 160 minims of the solution).

Cocaine, ... gr. iij.
Liquid medicinal vaselin, . . ad ♏ clx.

Used for local anæsthesia in neuralgia and in ophthalmology.

Aconitine, crystalline, ... gr. $\frac{1}{30}$.
Chloroform, ... ♏ xvi.
Liquid medicinal vaselin, . . ad ♏ clx.

Used in neuralgia, in doses of gr. $\frac{1}{64}$.

Digitaline, crystalline, ... gr. $\frac{1}{30}$.
Chloroform, ... ♏ xvi.
Liquid medicinal vaselin, . . ad ♏ clx.

Used in cardiac affections and asystoly, in doses of gr. $\frac{1}{130}$.

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Quinine, pure, ... gr. iss.
Chloroform, ... ♏ xvi.
Liquid medicinal vaselin, . . ad ♏ clx.
Used as a febrifuge. ♏ xvi. contain about gr. $\frac{1}{8}$ of quinine.

Pilocarpine, ... gr. $\frac{3}{4}$.
Chloroform, ... ♏ xlviij.
Liquid medicinal vaselin, . . ad ♏ clx.
Used in ophthalmology and in diphtheria, in doses of gr. $\frac{1}{6}$.

Solanine, ... gr. $\frac{1}{12}$.
Chloroform, ... ♏ xlviij.
Liquid medicinal vaselin, . . ad ♏ clx.
Used as an analgesic.

Eserine, ... gr. $\frac{3}{4}$.
Chloroform, ... ♏ xlviij.
Liquid medicinal vaselin, . . ad ♏ clx.
Used in ophthalmology, in doses of gr. $\frac{1}{8}$.

Atropine, ... gr. $\frac{1}{6}$.
Chloroform, ... ♏ xvi.
Liquid medicinal vaselin, . . ad ♏ clx.
Used in ophthalmology, in doses of gr. $\frac{1}{12}$.

Hyoscine, ... gr $\frac{1}{6}$.
Chloroform, ... ♏ xvi.
Liquid medicinal vaselin, . . ad ♏ clx.
Used in ophthalmology and as a hypnotic, in doses of gr. $\frac{1}{12}$.

Duboisine, ... gr. $\frac{3}{4}$.
Chloroform, ... ♏ xvi.
Liquid medicinal vaselin, . . ad ♏ clx.
Used in ophthalmology.

Daturine, ... gr. $\frac{3}{4}$.
Chloroform, ... ♏ xlviij.
Liquid medicinal vaselin, . . ad ♏ clx.
Used in ophthalmology, in doses of gr. $\frac{1}{12}$.

Apomorphine, ... gr. $\frac{1}{3}$.
Chloroform, ... ♏ xxxij.
Liquid medicinal vaselin, . . ad ♏ clx.
Used as an emetic, in doses of gr. $\frac{1}{6}$.

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Hyoscyamine, ... gr. ij.
Chloroform, ... ♏ xvi.
Liquid medicinal vaselin, . . ad ♏ clx.
Used in delirium tremens, in doses of gr. $\frac{1}{10}$.

Agaricin, ... gr. iss.
Chloroform, ... ♏ xxxij.
Liquid medicinal vaselin, . . ad ♏ clx.
Used in the profuse sweats of phthisis.

Cotoin, ... gr. xv.
Acetic ether, ... ♏ lxxx.
Liquid medicinal vaselin, . . ad ♏ clx.
Used as an antidiarrhœic and in ulcerations of the intestines, in doses of ♏ xvi. per day.

Caffeine, ... gr. viij.
Chloroform, ... ♏ lxxx.
Liquid medicinal vaselin, . . ad ♏ clx.
Used as a stimulant.

C. MERCURIAL INJECTIONS (calculated for 160 minims).

Calomel, ... gr. xiiss.
Liquid medicinal vaselin, . . ad ♏ clx.
Used in primary and secondary syphilis, in doses of gr. iss.

Yellow oxide of mercury, . . . gr. xv.
Liquid medicinal vaselin, . . ad ♏ clx.
Used in constitutional syphilis and in gumma of the eye.

D. MISCELLANEOUS INJECTIONS (in percentages).

Ether, ... 30 parts.
Liquid medicinal vaselin, . . . 70 "
Used as a stimulant and antispasmodic.

Paraldehyde, ... 10 parts.
Liquid medicinal vaselin, . . . 90 "
Used as a hypnotic in mania and melancholia.

Iodoform, ... 5 parts.
Ether, ... 15 "
Liquid medicinal vaselin, . . . 80 "
Used as a surgical antiseptic.

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Bromine, ... 10 parts.
Liquid medicinal vaselin, . . . 90 "
Used as a disinfectant and sedative, in diphtheria.

Aseptol, ... 1 part.
Liquid medicinal vaselin, . . . 99 parts.
Used as an antiseptic.

Phosphorus, ... 1 part.
Liquid medicinal vaselin, . . . 99 parts.
Used in sciatica and melancholia, in doses of gr. $\frac{1}{30}$.

Iodide of phosphorus, ... 1 part.
Liquid medicinal vaselin, . . . 99 parts.
Used in sciatica and melancholia, in doses of gr. $\frac{1}{12}$.

The substances employed must be pure: the ether and chloroform as prepared for anæsthesia, the eucalyptol that of Delpech, and the liquid medicinal vaselin should respond to the tests of H. Bocquillon, Adrian, and Boymond. The alkaloidal solutions must be prepared from pure ingredients, but mixed only immediately before use, otherwise the chloroform evaporates, the alkaloid is precipitated, and the dosage is wrong. Moreover, in the case of digitaline, aconitine, and atropine particular care must be taken, bearing in mind that digitaline has a tendency to act cumulatively, especially with vaselin which still more retards the absorption.

Vernonia nigritiana Ol.—Synonym: Batiator.

Description.—A plant belonging to the Order of Compositæ, indigenous to the Niger and central Africa.

Composition.—Contains a glucoside, vernonin, slightly soluble in ether and chloroform. Formula, $C_{10}H_{24}O_7$.

Therapeutical Properties.—It acts on the heart like digitalis, but is about eighty times weaker than the latter, which fact permits the graduation of the effects. The root is febrifuge.

Viburnum prunifolium L.—Description.—A plant belonging to the Order of Caprifoliaceæ, indigenous to the United States.

Part Employed.—The root.

Composition.—Contains viburnin, valerianic acid, and tannin.

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Therapeutical Properties.—Used in dysmenorrhœa and for preventing abortion and miscarriage. It is also antispasmodic, astringent, diuretic, tonic, and a nervous and uterine sedative.

Use and Doses.—Fluid extract, gtt. 30–50. Soft extract, gr. iss.–iij., in pills. Viburnin, gr. i.–ij.

Vicia (Common Bean).—Synonyms: Vicia faba, Windsor bean, large garden bean, fève des marais.

Description.—A plant belonging to the Order of Leguminosæ, indigenous to the whole of Europe.

Therapeutical Properties.—The dried flowers have been recommended by Bouloumié in nephritic colic and pain in the urinary apparatus, in doses of a pinch to the cup of boiling water.

The seeds are demulcent and resolvent, while their episperm is astringent. It is made into a clear gruel which is recommended in light diarrhœa.

Warras.—Synonym: Wars.

Description.—The kamala of Aden, probably derived from Flemingia Grahamiana W. and Arn., Order Leguminosæ, indigenous to India.

Composition.—Contains a red resin, flemingin [?].

Therapeutical Properties.—Used externally in skin diseases.

Internally, it is purgative and a specific for colds. Tænifuge like kamala. It serves also as a coloring matter.

Use and Doses.—As a tænifuge, the powder in doses of ʒ v. for adults, and ʒ iss. for children. Tincture (1:5), fl. ℥ i.

Withania coagulans Dunal.—Description.—A plant belonging to the Order of Solanaceæ, indigenous to India.

Physiological Properties.—Rapidly coagulates milk.

Therapeutical Properties.—Alterative and diuretic in chronic diseases of the liver.

The fresh fruit is emetic.

Withania somnifera Dunal.—Description.—A plant belonging to the Order of Solanaceæ, indigenous to India and the coasts of the Mediterranean.

Composition.—Contains an alkaloid, somniferine (Trabut).

Parts Employed.—The root and the leaves.

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Therapeutical Properties.—Local applications for ulcers, swelling of the joints, rheumatism, and dyspepsia (sic!). The seeds, which are emetic, are used in engorgement of the gall bladder. The alkaloid possesses hypnotic properties.

Xanthoxylum caribœum Gaert.—Synonyms: Xanthoxylum fraxineum Willd., Prickly ash.

Description.—A plant belonging to the Order of Xanthoxylaceæ, indigenous to the United States and the Antilles.

Therapeutical Properties.—Antirheumatic, sudorific, and diuretic.

The bark is largely used in dentistry, as a masticatory. It produces a sensation of heat in the stomach, with excitement and a tendency to diuresis. It is, moreover, a tonic in anæmia and debility. The decoction of the leaves is a powerful diaphoretic, used in tetanus.

Use and Doses.—Fluid extract, gtt. x.–xx. Powder, gr. viij.–xxx., two or three times a day. Decoction, ℥ i. in O i., boiled down, to be taken in twenty-four hours.

Xanthoxylum Naranjillo Gr.—Description.—A plant indigenous to the Argentine Republic.

Composition.—Parodi has extracted an alkaloid which he calls xanthoxyline.

Therapeutical Properties.—According to Parodi it can be used as a substitute for jaborandi. It is said to possess sialagogue, sudorific, diuretic, and stimulant properties.

Xanthoxylum senegalense D. C.—Synonym: Artar root.

Composition.—Contains two alkaloids; one acting like veratrine and producing spasmodic movements, the other like aconitine, increasing the energy of the heart-beats, and exciting a sensation of tingling on the tongue.

Therapeutical Properties.—The root is aromatic, stimulant, and diaphoretic.

Xylol.—Synonyms: Xylene, dimethylbenzene.

Preparation.—It is distilled from coal tar, the portion coming over between 280 and 284° F. being collected.

Description.—A colorless liquid, of an agreeable aromatic odor.

Therapeutical Properties.—Recommended as an antiseptic in place of phenol, being less toxic.

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Yerba santa B.—Synonym: Eriodictyon californicum Bent.

Description.—A plant belonging to the Order of Hydrophyllaceæ, indigenous to California and Mexico.

Therapeutical Properties.—Used in bronchitis, laryngitis, and other affections of the chest.

Use and Doses.—Syrup prepared from the leaves, used for masking the taste of quinine, whose medicinal effects are not affected by it. Fluid extract, ʒ ss.–i. per day.

Zigadenus venenosus.—Synonyms: Hog's potato, death camoss.

Description.—A plant belonging to the Order of Colchicaceæ, indigenous to South America.

Therapeutical Properties.—A violent narcotico-acrid poison, causing intense convulsions, with great thirst and vomiting. It dilates the pupil, and may cause death in coma.

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DISCUSSION ON

ANÆSTHETICS.

BY

DR. WILLIAM MACEWEN, DR. JOSEPH COATS,
DR. T. BROWN HENDERSON, DR. HARTLEY,
AND
DR. ROBERT KIRK.

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DISCUSSION ON ANÆSTHETICS.[1]

CHAPTER I.

INTRODUCTION.

BY THE PRESIDENT, DR. WILLIAM MACEWEN.

GENTLEMEN:—The subject of anæsthesia and the properties of various anæsthetic agents is one in which medical men have at all times a keen interest. Lately this interest has received a fillip by the publication of the report of the Hyderabad commission. The conclusions arrived at in this report have given rise to much comment. Various members of this society have expressed a belief that a discussion on anæsthetics might be profitable, and the council have accordingly arranged to set apart one or two evenings for that purpose, so that all who have a desire to participate in the discussion may have an opportunity of doing so. It would facilitate the arrangements, however, were the names of those members who wish to speak given to the secretary. While in no way wishing to limit the discussion, it is hoped that the observations of the various speakers may be arranged, as far as possible, under the three heads mentioned in the billet:

1. The relative value of various anæsthetics.
2. Their mode of administration, including the examination and preparation of the patient.
3. Fatal issues, how they arise and how to avert them.

Another point might be put to the practitioners present. Is it possible in the emergencies of practice to have two registered medical practitioners always present when an anæsthetic is administered? Were a law to that effect established, would it increase human suffering or endanger life? It would, as a rule, be easy for surgeons in hospitals or in large cities to obey

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it; but in private practice, and especially in remote districts where the nearest medical man may be miles distant, such a law might tell hardly on the patient. A man with dislocation of the hip might require to remain in excruciating agony for hours owing to a second practitioner not being forthcoming. Instead of imposing a restrictive law of this kind, would it not be better, if something further is required, to insist upon special certificates being granted for proficiency in the administration of anæsthetics? The holder of these certificates might be obliged to give evidence as to his thorough acquaintance with the physiological actions upon the human being of the principal anæsthetic agents, as to the manner in which fatal issues arise, and how to avert these. Then, after having passed a written examination on the above, he might be required to administer, under the eye of a competent teacher, an anæsthetic to patients on, say, twelve occasions. When he has done so to the satisfaction of this teacher, a certificate of competency might be then granted. A scheme of this kind has been followed by me in the Royal Infirmary among my own students, certificates being granted after they had passed the various examinations. This presupposes that examinations and teaching on the subject of anæsthesia are at present insufficient. The multiplication of certificates in various departments of medicine is in a sense undesirable; but were the anæsthetic certificate insisted on, it would insure greater attention to the subject. It is quite as important as a certificate of proficiency in vaccination.

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CHAPTER II.

THE ACTION OF ANÆSTHETICS ON THE RESPIRATION AND CARDIAC ACTION, AND ON THE RISKS INCIDENT TO THIS ACTION.

By Joseph Coats, M.D.

Mr. President and Gentlemen:—The object of such a discussion as this, as I apprehend, is to keep men's minds alive to the dangers incident to the use of anæsthetics, and to see whether, by the mutual comparison of experiences, we may be able to assist each other in avoiding these dangers.

That there are dangers in the administration of chloroform few will deny. It is difficult to get at reliable statistics as to the mortality from chloroform, and I have thought it worth while to try and determine the proportion of deaths in the Western Infirmary to the number of administrations. I have gone into the matter with the assistance of Dr. Russell, the superintendent, and have come to the conclusion that chloroform has been administered about 10,000 or 12,000 times to in-patients since the opening of the hospital in 1874. (This is merely an estimate and may be much under the mark. Indeed, from the frequency with which chloroform is given in one set of wards, it may be necessary to increase these figures by a half. Dr. Russell will for the next year make a daily note of the administrations, so as to afford a reliable basis.) There have been at least five deaths, which gives a proportion of one to 2,000 or 2,500, which I believe to be about the average.

My contribution to the discussion will consist in an exposition of what I conceive to be the physiological problems involved in the administration of anæsthetics, and of the dangers to which the physiological action of the agents exposes the patient.

My earliest introduction to practical physiology was in the year 1869, when, in the laboratory of Professor Ludwig, in

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Leipzig, I undertook a series of observations on the capabilities of the heart of the frog under varying circumstances. It was impressed on my mind that the heart is an organism complete in itself. The regular preliminaries to my daily observations were devised in order to separate the organ from all control outside itself. I amputated the head, thus removing the brain, and I destroyed the spinal cord. I then removed the abdominal viscera and the hind limbs, cutting through the spine in the middle of the back. There was thus left little of the animal but the heart and its great vessels with the connected nerve-semts. Yet this isolated organ, when duly supplied through the vena cava with the blood-serum of a rabbit, was found capable of prolonged and continuous work, the systole and diastole following in rhythmic sequence, so that very striking variations in pressure could be registered by means of a canula introduced into the aorta and connected with a suitable instrument. The heart, it was obvious, is to a large extent self-sufficient, and contains in its own substance an entire nervous system which is indeed susceptible of control from above, but has a considerable degree of independence. I was again impressed by this fact when, a year afterward, Recklinghausen showed me a frog's heart still beating which he had kept detached from the body in a porcelain capsule for a week. He had simply taken precautions that it did not suffer from loss of moisture or from interference by external objects. The movements of the heart are under the control of its own intrinsic ganglia, and this is demonstrably true in regard to the mammalian heart as well as that of the frog.

It is different with the respiratory movements. These are effected by a very complex mechanism acting as a suction pump, with a valve at the inlet. The various parts of the mechanism are co-ordinated and controlled, not in the mechanism itself, but at a distance from it, in the medulla oblongata, where we have the so-called respiratory centre.

The two great actions of the body without which life cannot exist are respiration and circulation. If these persist the person is alive, although all other functions are in abeyance. It follows from this that death occurs by the cessation of one or other of these great functions, and by no other method. The direct cause of death is always stoppage of the respiration or of the heart's action. We go through life, and our ex-

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istence from minute to minute depends on the automatic action of the two centres to which I have referred. The respiratory centre is somewhat under the control of the will and we can vary the rhythm of its action. We are more conscious of our dependence on respiration, and of old, the Breath of Life has been regarded as expressive of the essence of the matter. The action of our hearts is less obtrusive, and to most people it is usually outside their consciousness and so is less observed.

The object of an anæsthetic is to suspend the action of the nerve centres which have to do with sensation and motion while leaving the respiratory and cardiac centres intact. It is not surprising that these latter centres, which continue under all circumstances, throughout life, their rhythmic action, should be more resistant than others, and that they should persist in their function after other centres have succumbed. We may expect, however, that any agent which suspends the function of the centres of sensation and motion will have some effect on those of the respiratory and cardiac centres, and there is abundant evidence to show that all anæsthetics which produce their action by being introduced by some method into the blood, are capable of affecting both the respiratory and the cardiac centres.

Chloroform and ether are the two typical anæsthetics. It has been shown by experiment that both of these substances have an effect on living and active structures of various sorts. It has been pointed out, for example, by Bernard that the sensitive plant loses its power of movement in its leaves when placed under a bell-jar along with a sponge saturated with one of these agents, to recover afterward when freed from its action. In the words of Bernard, chloroform "really acts on all the tissues; it affects each element in its turn, according to its susceptibility," and so we may say that anæsthetics act directly on muscular contractibility, on glandular secretion, on cellular activity of all sorts as well as on nerve centres, the last-mentioned, however, being the most sensitive of all.

The dangers of anæsthetics are in proportion to their action on the two great strongholds of life, already mentioned. In order to estimate these dangers we must consider more closely in what different ways the respiratory or cardiac function may be suspended.

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I. Effects on the Function of Respiration.

Let us take, first of all, respiration. I think we can recognize three different ways in which this function may be interfered with during the administration of anæsthetics. For one thing, there may be a direct obstruction to the entrance of air. Stertor is frequent under the administration of chloroform. It is a very important service of our old teacher, Lister, that he has shown that this stertor is often not the inoffensive palatine stertor which constitutes ordinary snoring, but is a laryngeal stertor, produced by the approximation of the posterior parts of the arytæno-epiglottidean folds. These folds of mucous membrane produce by their vibration the stertorous noise, and they may become so closely approximated as to produce complete obstruction. This is a most important mode of obstruction. Of less frequency and importance are falling back of the tongue and depression of the epiglottis. Both these forms of obstruction are removed by pulling forward the tongue, this operation relieving the stertor in the larynx, and also raising the tongue and epiglottis.

A second mode of obstruction has been forcibly pointed out by the Glasgow Committee on Anæsthetics in the part worked out by Dr. Newman—namely, a retardation and stoppage of the circulation in the lungs, first in the capillaries, then in the arterioles, and subsequently in the larger vessels. It seems likely that chloroform when administered by the lungs produces, as a direct local action, such a change in the walls of the vessels as to cause a retardation of the blood-current. This engorgement of the lungs with blood will be equivalent to an interference with respiration.

But, in the third place, when we speak of an anæsthetic acting on respiration we generally think of it interfering with the nervous centres which govern the respiratory movements, and when we discuss whether death has been by the heart or the respiration it is usually these centres which we have in mind. I may here quote a single sentence from the report of the Glasgow committee already referred to: "It soon became apparent to us that chloroform, administered to dogs and rabbits, has a disastrous effect on the respiratory centres; it is easy to kill one of these animals by pushing the chloroform till respiration is paralyzed." It is plain that the direct poi-

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soning of these centres by the agent used is a serious danger in the clinical use of chloroform. The paralysis of the respiratory centres, however, is not always so simply brought about as this. It may depend to some extent on an insufficient supply of blood to these centres induced by depression of the heart's action, which will be subsequently considered. Let it be stated with all emphasis, and always borne in mind in every administration of chloroform, that we are dealing with an agent the object of whose use is to paralyze nerve centres. It has this paralyzing effect on the respiratory centres as upon others, and this effect must be seriously taken into account.

II. Effects on the Cardiac Function.

Let us turn now to the much-debated question of the influence of anæsthetics on the heart. As in the case of the respiration, we have here again a somewhat complicated problem. I have already pointed out that the proper centres of the heart are in the walls of the organ itself. It is they which directly command the rhythmic movements of the heart. But these centres are in relation with the central nervous system by nervous connection, with the vagus nerve on the one and the sympathetic on the other. For our purposes here the connections with the vagus are the more important. Stimulation of the stem of vagus or of the cut end causes an inhibition of the intrinsic ganglia in the heart, so that the pulsations are diminished or caused to cease. This well-known effect of stimulation of the vagus indicates that the centre of the vagus nerve in the medulla oblongata exercises a control on the action of the heart, and that, by means of this mechanism, as part of the chain in a reflex circle, we may have influences from a distance acting on the heart in the direction of curtailing or stopping its movements.

In considering the effects of anæsthetics on the heart, it is necessary to keep carefully in mind the two methods in which the heart's action may be interfered with. There is, first, the direct action of the agent on the intrinsic ganglia, and there is, secondly, the action through the vagus. I think it is possible both in recorded experiments on animals and in the records of deaths from chloroform to recognize these two forms of influence.

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I am afraid that it will be necessary here to say something in general terms as to the influence of the heart on the circulation and how this influence is measured in physiological experiments. In order to the carrying on of the circulation a certain amount of constant pressure is necessary in the vessels. This blood-pressure being a positive force is due fundamentally to the contractions of the heart. But in order that the pressure may be retained it is necessary that there should be some resistance to the easy escape of blood at the periphery, and this is effected by the state of contraction of the finer arteries. The water issuing from a pump is at a low state of pressure while it obtains free exit. If you narrow the exit by placing the hand on the spout, the pressure rises and the water spouts from the vent-hole. Blood-pressure may be reduced, either by diminishing the force of the pump—that is, by weakening the heart—or by diminishing the peripheral resistance—that is, by causing dilatation of the arterioles.

This being borne in mind, let us turn to the influence of the vagus in interfering with the action of the heart. I have hung up the exact magnified copies of two tracings showing the effect of stimulation of the vagus in the frog. They were obtained in the early series of observations on the heart of the frog to which I alluded at the outset. These, like the other tracings shown, were obtained by inserting a canula in an artery and connecting this with a mercurial kymograph in such a fashion as that the variations in pressure should be written on a revolving drum in the usual way. It will be seen in the first figure that the effect of a slight stimulation of the vagus is to produce an elongation of the pause, and a distinct lowering of the pressure during this elongated pause. In the second figure we have the results of a more considerable stimulation of the nerve, and it will be seen that not only is there a long pause produced, but that the blood-pressure is reduced to zero, and when the pulsations are resumed they are at first very insignificant, although somewhat rapidly returning to the normal.

Applying this to the state of matters under an anæsthetic, we must remember that the vagus influence is the result of stimulation. In the course of anæsthesia it can only be brought about by a stimulation of the vagus centre in the medulla oblongata. It can scarcely be a direct effect of the anæsthetic,

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therefore, else we should rather expect a paralyzing influence, and we must look rather to a reflex influence on this centre.

Dr. Kirk has, in a brochure recently published,[2] forcibly drawn attention to reflex action as a cause of syncope under chloroform. Dr. Kirk says hard things about the Glasgow Committee on Anæsthetics, of which I am a humble member. Charybdis is the rock on which we stumbled, "not having previously suspected its existence." But Dr. Kirk is even more dissatisfied with the Hyderabad commission, who it seems have fallen on Scylla. I will leave Dr. Kirk to explain his own theory, which I have no doubt he will do in the course of this discussion, but I may say that I have difficulty in apprehending how the results he refers to can arise by reflex action. He speaks of the chloroform applied to the mucous membrane of the lungs acting reflexly on the systemic circulation like a tourniquet, and of the withdrawal of the tourniquet as producing "a violent rebound or whirl of the circulation, terminating, in its most pronounced form, in syncope." If Dr. Kirk could be more explicit in his use of terms, explaining, for instance, what he means by the mucous membrane of the lungs, a very unscientific term, and what he means by this tourniquet, it would be easier to follow him. I do not think there is much in the new theory, but I have to thank Dr. Kirk for so forcibly calling attention to the early syncope of chloroform and emphasizing the possibility of reflex inhibition.

The Glasgow committee, let it be said, did not ignore this reflex influence. I have hung up a copy of a tracing which was published in the report, and is the tracing to which the Hyderabad commission several times refer. You will notice that this tracing closely resembles the vagus tracing. There is, to begin with, a high pressure, then a sudden fall, only interrupted for an instant by a respiratory movement, but going down to zero with great slowing of the cardiac contractions. This is followed by a somewhat rapid rise with exaggerated respiratory variations. Now, this phenomenon occurred in a dog which was recovering from chloroform; none had been given for two minutes. It could scarcely have arisen from the paralyzing influence of the agent, and it was stated in the words of the report to be "apparently reflex in character." It is of great interest that in the case of this same dog a somewhat similar fall of blood-pressure with slowing of the heart

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occurred when the animal was recovering from chloroform a second time (see tracing B in report).

This is clearly a vagus effect, and reflex in character. In the report we do not venture on an explanation of the origin of the reflex process: we only say that perhaps the conditions were favorable for such reflex processes. In this connection it may be here added that the influence of an anæsthetic may be to increase at some stages the reflex irritability of certain centres. It is well known that the withdrawal of the influence of higher centres often increases the irritability of lower ones. The case of the decapitated frog is the most striking instance, the absence of the brain as a controlling centre rendering the spinal reflex centres more active. And so it may be that, the higher centres being dulled by the anæsthetic more readily than the lower, we may have, during recovery and before complete anæsthesia, a special sensitiveness of this reflex mechanism, and a special tendency to vagus inhibition of the heart by this means. In this respect it is interesting to find, according to the report of the Glasgow committee, that in rabbits, "when the animal is not fully under chloroform, any fresh administration causes most remarkable variations in blood-pressure, with retardation of the heart's contractions" (see tracings G and H in report). This also is ascribed to reflex action and was referred to the action of the chloroform vapor to the nostrils of the animal, just as the application of ammonia vapor to the nostrils of the rabbit produces stoppage of the heart's action.

We may say, then, that before the period of full narcosis, and during recovery, the reflex vagus centre seems to be unduly active, and there is serious risk of syncope from stoppage of the heart. To this category belongs death from shock during narcosis. This cannot occur when the animal is fully under the influence of the anæsthetic, because the reflex centre will share in the paralyzing influence; but it may occur from comparatively trifling causes when that centre is unduly active—a very important fact.

In this connection, the period at which death occurs is of considerable importance. In Dr. Lyman's book on anæsthetics there is a careful collation of published cases of death from chloroform, numbering in 1881 no fewer than 410. The period of death was obtainable in 219 cases, and is stated in the following table:

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At the commencement of inhalation, . .	15
Before complete insensibility, ...	99
During the period of insensibility, . . .	70
After completion of the operation, . . .	35
	219

It is of great consequence in this reference that a reflex inhibition of the heart is likely to be much more easily recovered from than one due to direct paralysis of the organ. If respiration be kept up the heart is likely to recover, unless the stoppage has been so prolonged as to allow of the accumulation in the blood of carbonic acid sufficient to cause further mischief.

Direct influence of the anæsthetic on the cardiac centres is the second mode in which the cardiac action may be affected. As will be seen farther on, this influence is inferred chiefly by the effects on the blood-pressure. I have already pointed out, however, that the action of the heart, although the determining cause of the blood-pressure, is not the only element. Pressure will be reduced by paralytic dilatation of the peripheral arteries, as well as by weakening of the heart. This paralysis may be due either to an action on the vaso-motor centre in the medulla oblongata, or to a directly paralyzing action of the anæsthetic on the arterioles or their immediate local nervous apparatus.

The effect of anæsthetics on the intrinsic ganglia of the heart was considered by the Glasgow committee, and in their report it was stated, on the basis of experiments I myself conducted, that the heart of the frog is very sensitive to chloroform vapor. When the heart is exposed under a bell jar to air charged with chloroform, "the heart became rapidly weaker till it ceased beating;" to recover when the chloroform atmosphere was removed. In this respect chloroform contrasted with ether.

In the current number of the "British Medical Journal" (11th October) there is the first part of a paper in which Dr. M'William records certain experiments directed toward this subject. This observer has devised an instrument by means of which "a simultaneous direct graphic record of the action of the auricles and the ventricles was obtained, alongside of a tracing of the arterial pressure." The results of these observations, so far as the heart is concerned, are thus stated:

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"Chloroform acts upon the heart; it causes a marked depression of the cardiac muscle, involving a reduction of its tone, a relaxation of the cardiac walls, and an impairment of their functional efficiency." In this respect ether, as in our observations, presented a great contrast to chloroform.

The relative influence of relaxation of the arteries and paralysis of the heart in reducing blood-pressure is summarized in a paragraph which, on account of its importance, I may be allowed to quote almost entire:

"The fall of blood-pressure caused by chloroform is due primarily to the depressing influence of the drug on the vaso-motor centre, leading to arterial relaxation. . . . It has already been stated that when chloroform is given in such an amount as to cause a marked fall of pressure, there commonly occurs at the same time a more or less marked dilatation of the heart. In the healthy animal the latter change does not, in the earlier stages of a fall of blood-pressure, appear to play nearly so important a part in lowering the pressure as does the depression of the vaso-motor centre, induced by the influence of the chloroform. But in the later stages of a great fall of blood-pressure, when the anæsthetic is given so as to produce a profound effect, the cardiac dilatation becomes a factor of prime importance, and it becomes impossible to raise the pressure by any means affecting the arterial system alone; the pressure can only be raised by restoring, in some measure, the pumping power of the heart, or by the supplying of some mechanical substitute for this power—for example, by a rhythmic compression of the ventricles with the hand." We may infer, I think, that an extreme fall of pressure, associated with slowing or stoppage of the heart, is due to failure of the heart, even although technically the heart may not actually have ceased beating.

In the experiments of the Glasgow committee there were numerous examples of a gradual fall of blood-pressure, in some cases becoming extreme, but as they were made with a quickly-revolving machine and so occupy a great length, I have reproduced one of the tracings published by the Hyderabad commission which shows characteristically the points which I want to bring out. It is one of many which might be adduced. It is Experiment 169 in their series, and is copied from the "Lancet" of 21st June, 1890. It will be seen that the

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blood-pressure as registered by Ludwig's kymograph is good, the dog coming out of chloroform. A tracing taken with Fick's apparatus at 1 shows also that the pulsations have considerable amplitude. Then chloroform is given "gently," with the almost immediate effect of a fall in blood-pressure. In the midst of this fall the Ludwig tracing is interrupted and No. 2 is taken with Fick's kymograph. The amplitude of the pulsations has now diminished to half, but the respiratory variations are still visible. There is a still further fall of blood-pressure, and about three minutes from the beginning of the administration a Fick tracing (No. 3) is taken. Here the pulsations are very feeble indeed, and the respiratory variations are still visible. After this there is a more rapid drop, so that at the end of about four minutes the blood-pressure is reduced almost to zero, and the Fick tracing No. 4 shows the heart to be making the most feeble and inefficient pulsations. Just before this the respiration has stopped.

This is a complete picture of a gradually deadening effect of the agent on the action of the heart. The blood-pressure and the efficiency of the heart undergo a gradual diminution. I believe the respiratory centres are similarly affected, and in such a case as this it may be a question whether death has resulted mainly from failure of one or the other. At least the weakened circulation must have acted on the respiratory centres, diminishing the supply of blood necessary to their efficiency. It is to be noted that here the chloroform was being given "gently."

I will here call your attention to a tracing of our own, in which, although the fall of pressure is still gradual, yet it is more sudden than in the experiment just referred to. Here also is a dog which has had chloroform and is recovering. The pressure is good. More chloroform is given, with the result that there is soon a distinct but irregular fall of pressure. This lasts about a minute, and then there is a much more rapid and extreme fall of pressure, with slowing of the heart's action such as we find in the vagus action. Whether this is a vagus action or not, it is produced more than a minute after the animal had begun to receive a fresh dose of chloroform, and not when he was recovering from it. At the time of this great fall the chloroform was removed. Notice also that during this period of low pressure and great slowing of the heart the

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respiration continues. After a short time the pause of the heart ceases and the pulsations are resumed, but the pressure is so low that they are quite inefficient. After twenty-nine of these pulsations the breathing stopped, while the pulsations went on regularly as before. After a few seconds artificial respiration is resorted to, by alternately compressing the chest and allowing it to expand. This being prosecuted for thirty seconds, spontaneous respiration was resumed and the pulsations of the heart became more marked, having a higher excursion than before. After other forty-two seconds the pressure begins to rise, and this rise goes on continuously till the normal is resumed.

Here again we have, as I think, a most instructive picture. There is the great reduction of blood-pressure. We have slowing and stoppage of the heart while the respiration continues, and we have stopping of the respiration some time after the blood-pressure has been reduced to zero. The heart resumes its action, and after artificial respiration has been used for a time this function is also resumed. Here we have undoubtedly, as I think, a cardiac failure in the midst of a chloroform administration, and a failure of the respiration secondary to that of the heart.

The Hyderabad commission have asserted that in this case and the others in which our tracings show a sudden fall of pressure there has been a stoppage of respiration by the animal holding its breath or otherwise, and that the effect is due really to asphyxia. They have done us the honor of making this matter the subject of many special observations. We have elsewhere replied to their observations, but I venture to think that a careful examination of this tracing, as published in our report and reproduced here, would have disabused their minds of any such idea as that this was the effect of asphyxia. The tracing was published without any expectation of such strictures, and it bears on its face their refutation. Remember that asphyxia, by obstructing the air-passages, only produces a fall of pressure after a considerable interval, in some of the curves of the Hyderabad commission as long as two minutes. But in our tracing as shown, the respiratory variations in pressure are visible even after the commencement of the rapid fall, being only abolished by the absolute abolition of the blood-pressure. The tracing, however, bears the note,

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"Respiration continues," and afterward there is a note as to its stoppage.

These two tracings lead up to a question as to an overdose of chloroform. I find some differences of opinion in regard to this matter. I would meanwhile remark that in both the tracings shown the agent was not given in a concentrated form. In the Hyderabad tracing it is given "gently," and I presume on a folded towel. In our case it was given on a folded towel held over the muzzle. Now, I understand from Dr. Kirk's monograph that an overdose cannot be given by this method. He says: "As will be shown a little farther on, it is impossible to get an overdose from a towel at 70° F., however freely the liquid be poured on it." Farther on he refers to the concentration of the chloroform atmosphere as the essential point in this matter, and, as the folded towel can only give an atmosphere containing 3½ per cent, there is therefore no danger of an overdose.

As this is an important matter, let us look at it a little more closely. In regard to the concentration of the atmosphere we see, in the first place, that the continuous administration of chloroform by the towel, as in the tracings of the Hyderabad commission and of the Glasgow committee, reduces the blood-pressure, and leads in some cases to paralysis of the respiration and in others to paralysis of the heart. That is an actual fact. But, again, it is to be borne in mind that concentration of the atmosphere is by no means the only element in the question of an overdose. The depth and frequency of the respirations, for instance, must exercise a very great influence on the amount of chloroform absorbed by the blood. The rate of the blood-current in the lungs is another very serious element. The problem of an overdose concerns the amount of the agent in the blood, and although the concentration of the atmosphere is an important element, it is by no means the only one.

The question of the concentration of the atmosphere has been made the subject of experiment by Snow, Paul Bert, Lister, and others. Lister's account of the matter in the third edition of Holmes' "System of Surgery" is peculiarly instructive. According to Paul Bert, we can distinguish three degrees of concentration of an anæsthetic according to the physiological effects. There is a certain percentage below

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which the agent fails to produce anæsthesia at all, and there is another high percentage above which it leads to a fatal result. Between these two there is what he calls the workable zone, within which the anæsthetic is safe and effective. This is a very satisfactory statement, with all the French completeness and system. But when tested by Lister what do we find? Experimenting with white mice and working in the middle of Paul Bert's "workable zone," a young mouse was killed in fifteen minutes and an adult in four minutes. When the chest of the latter was opened the heart was found to have lost its irritability. It was observed, moreover, that on different days the effects varied considerably in the same animals. Lister, for example, referring to one of his experiments, says: "It will be observed that two and a half per cent, though it anæsthetized more slowly, yet killed sooner than four per cent had done on the previous day."

In this reference I also think it worth while to quote *in extenso* an observation by Lister, which confirms very strongly the results which the tracings hung up seem to bring out. Lister says:

"I had always supposed that a chloroform atmosphere sufficiently strong to produce anæsthesia would, if continued, soon lead to a fatal result. Such certainly is apt to be the case with chloroform administered by means of a folded towel. It once fell to my lot to see a patient who had been left for only a few minutes with the cloth lying over the face after full anæsthesia had been produced, in consequence of the attention of the administrator having been distracted by other matters; and I shall never forget the result. Respiratory movements had entirely ceased, and the face had a deadly pallor, and for a while it appeared as if the patient was dead, though happily revival took place after protracted artificial respiration. And I have seen other patients thrown into a condition of distinct peril from the same cause carried to a minor degree."

My own conviction is that where the atmosphere is well charged with chloroform and the patient is breathing deeply, the blood may become so saturated with the agent as to seriously endanger both the respiratory and cardiac centres. In using the towel, replenishing the chloroform at intervals, the degree of concentration of the atmosphere must vary greatly from time to time, and if a period of greater concentration

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happens to coincide with a period when the patient is inspiring deeply, there is considerable danger of paralysis of the centres referred to. This argument would bear strongly in the direction of the use of an inhaler which would insure a constant degree of concentration in the atmosphere that the patient inhales.

Concluding Remarks.

Gentlemen, I have said little and, I suppose, much less than some expected, of the comparative merits of ether and chloroform. In regard to the immediate dangers to which I have referred in what has gone before, I am firmly convinced from multiplied experiments that ether exercises much less of a paralyzing action on the intrinsic ganglia of the heart than chloroform does. The observations recently made by Dr. M'William are also confirmatory of this. I do not know what is their relative action on the respiratory centres, but I suspect that in this respect also ether has the advantage over chloroform. So far as laboratory experiments are concerned, I believe that ether comes out distinctly better than chloroform, but I freely acknowledge that the matter cannot be arbitrarily decided by laboratory experiments. There are other considerations which only practical men can duly appreciate, such as the after-effects of ether and chloroform respectively, in relation to the chances of recovery from operations. If the superior safety of ether during the immediate administration is more than counterbalanced by the more serious effects, or by its inconveniences and difficulties during prolonged operations, then the scale will turn in favor of chloroform.

In any case, so long as chloroform continues to be used, I think every one who administers this agent should make himself aware of the dangers, and should always bear in mind the indications which announce the imminence of these dangers. Every administration of chloroform is, in itself, a serious operation. It should only be undertaken with a feeling of responsibility and with the consciousness that the life of the patient is in the hands of the administrator; it should take up his undivided and constant attention. An experienced and observant man will instinctively gather from numerous indications the approach of danger, and it would be matter for

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astonishment if, in the hands of any such person, be his theory what it may, the dangers were not reduced to a minimum. The less experienced administrator should remember that in the course of administration there are three serious risks in sight. There is the risk of an early and sudden syncope from reflex inhibition of the heart. This is minimized by a continuous and sufficient administration, and it is less dangerous than the other, from the fact that it is reflex and leaves the heart intrinsically unaffected. Artificial respiration when used early enough should always produce recovery in this case. There is, secondly, the danger of obstruction of the respiration by laryngeal causes, the remedy for which is simple enough. There is, lastly, the danger from the paralyzing effect on the great centres of respiration and circulation. I place these together because I think it a great mistake to take up the position of a partisan for one or other. I believe that as these are the last great nervous centres to be affected by the anæsthetic, they are liable to be affected by similar degrees of influence of the agent. When once anæsthesia has been produced, it is proper by a continuous regulated administration to keep up the condition, avoiding on the one hand too great a saturation of the blood, and on the other such a partial recovery as shall expose the centres in the medulla oblongata to reflex influences while the operation is current.

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CHAPTER III.

ON THE RELATIVE VALUE OF THE VARIOUS ANÆSTHETICS.

By Dr. T. Brown Henderson.

Mr. President and Gentlemen:—Next to ether and chloroform nitrous oxide gas appears to be the most useful anæsthetic agent. For short operations, requiring only a brief narcosis, it is admirably adapted, as it is rapid in its operation, and recovery from its effects is equally speedy, and it can be employed anywhere. It is gaining the confidence of surgeons, and I think it might well be in all our operating theatres. St. Bartholomew's Hospital, London,

In 1885, used it alone in 378 operations;
In 1887, " " 417 "
In 1889, " " 686 "

At the present time nitrous oxide is always given by anæsthetists in London before, and along with, the administration of ether. By this arrangement the narcosis is more speedily induced and the preliminary taste of ether is avoided. It is a luxury and is suitable for timid people particularly; besides being speedier, it is found to be safer than narcosis by any other plan.

By the kindness of one of the senior surgeons of St. Bartholomew's Hospital, one of the registrars has prepared for me a table showing the various anæsthetics used during the past fifteen years.

Chloroform was used 17,666 times, with 12 deaths, or 1 in 1,472 cases; ether, 7,493 times, with 1 death; gas and ether, 16,806 cases, with 1 death; methyline, dichloride of ethydine, ethyl bromide, ethydine and gas, and various other anæsthetics, 660 cases. These figures speak for themselves; they need no comment.

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Ether has been usually given by the open method—poured on a folded towel or one fashioned into the form of a cone. The ingenuity of inventors was exercised, but always in the same direction—Runde's mask and flannel cap, Cheatham's, Hearn's, Snowden's, Lente's, and Allis' inhalers were all on the same principle. The large quantity of unmodified ether vapor taken into the trachea and lungs usually caused much struggling, coughing, and distress in breathing, and was frequently followed by troublesome and dangerous affections afterward. Ormsby, of Dublin, invented an inhaler which, though very defective, yet suggested the idea of rebreathing the ether to Clover, who, about 1876, invented his portable instrument, by far the most perfect, safe, and economical inhaler at present known. No doubt some skill is required with this instrument to use the anæsthetic properly. It is easily learned. In Leeds a senior student frequently gives it. There are three ways it may be given—badly, well, and artistically. When given in the first way, it is, perhaps, equal to chloroform, and with it the surgeon has fewer frights to recover his patient. When given well it will never be given up, though in several hospitals I visited, even where there was a professional anæsthetist, "how not to do it" appeared to me to be too common. It is probably in such cases that the need has been felt of getting the patient first under with chloroform, and continuing the narcosis with the Clover's ether apparatus. These do not know the power of the instrument. It has been owing to the persevering efforts, during many years, of Mr. T. Pridgin Teale, of Leeds, that the development of the capabilities of ether by Clover's portable inhaler has been made so well known. He has guided the administration in private and in the general hospital many thousands of times with invariable success, and with a rapidity in the production of anæsthesia that more than equals, if it does not surpass, the success of the induction of anæsthesia by chloroform. His surgical life has been quite different since he has used ether by this method. The injurious after-effects attributed to the use of this substance from the old forms of giving it, are completely overcome by the Clover's inhaler, for not only is the amount of ether immensely reduced, but it is introduced into the lungs in a warm condition, and it is rebreathed over and over again, obviating the danger from cold which its ordinary evapora-

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tion produces. By Mr. Teale's mode of giving ether wonderful results are attained, as well in great operations by Wells, Keith, etc., as in smaller ones. When the operator studies, loves, and does not fear his instrument, the effects are usually of the best kind. In Leeds hardly any case is considered unfit for the giving of ether. The patients take it kindly with perfect confidence; old and young are easily and effectually brought under its influence. The old and bronchitic, by judicious management, have only a small quantity of well-warmed ether, and a very little suffices. But I must not anticipate Mr. Hartley, the visitor from Leeds, who is with us to-night. He has had experience in the administration of thousands of cases, and can speak with great emphasis and precision as Mr. Teale's valued assistant and as assistant surgeon to the General Infirmary.

Chloroform.—The danger from giving chloroform in small doses nowadays is, I think, the exception. I never hear of the long time of getting the patient under that was not uncommon many years ago. For many years, to push boldly on with the anæsthetic has been the practice all over the United Kingdom, and it is wise to do so in threatened vomiting, etc. "To make haste slowly with boldness, tempered by wisdom, is the way to carry the subject into the dark valley which borders on death, and drown human agonies in Lethe, and triumph in the crowning glory of his art." But there are cases where A. C. E. or ether is preferable—such as those who have much fear of the operation or of the chloroform; if the vital powers are weak from great delicacy or from exhausting illness; if the cardiac, or the pulmonary, or the nervous system is specially sensitive to chloroform; if there is excess of urea in the blood, or of albumin in the urine, or damaged kidneys. One of the difficulties of chloroform anæsthesia is from the uncertainty of the quantity necessary to induce narcosis. The most recent book on anæsthetics (Foy) gives the account of a patient who was with difficulty recovered from the narcosis produced by three drops of chloroform placed on a piece of cotton wool put into a hollow tooth; and of another who was narcotized by five drops of chloroform through a Snow's inhaler. Idiosyncrasies such as these may be more common than is supposed, just as some are rapidly and severely affected by small doses of mercury, opium, and other drugs. The ex-

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amination of the tables of statistics given by Dr. Lyman as to the exact time of death relative to the stage of anæsthesia appears to support this view.

	Before the Operation.	During the Operation.	After the Operation.
Sabarth, . .	54	42	25
Scoutleten, . .	22	6	12
Kidd, . . .	14	14	7

The report of the committee of the Medico-Chirurgical Society of London gives 88 deaths before and during the operation, of which 50 appears to have preceded operation, 14 after completion of the operation, and 7 at a period not recorded.

Chloroform—Mode of Administration.—I think the safest way is that introduced by Mr. Bloxam, of St. Bartholomew's, London. A few drops are sprinkled on a starched towel or flannel cap, and a drop added every second. It is speedily successful in producing anæsthesia, though in some cases it may be a little longer than when it is poured on more freely. I think the administrator keeps a better grip of his patient by the drop system.

Preparation of the Patient.—Before chloroform administration, it is well to allow a light, nourishing, easily-digested meal four hours previously. Before ether, no food should be taken for six hours previous to its administration.

Prevention of Accidents.—Some years ago the nitrite of amyl dropped on lint and held over the mouth was supposed to prevent and recover from accidents. It was also used, mixed with chloroform, as chloramyl, but after a short administration it was found to lower the blood-pressure instead of raising it. Inhalations of ammonia, in cases of weak or fatty heart, have been found useful previous to the use of chloroform. Oil of turpentine 1 part, chloroform 4 parts, was believed to prevent pulmonic paralysis.

Hypodermic injection of morphia half an hour before the administration of chloroform was supposed to be useful in preventing a fatal issue.

At a discussion on this subject at the Academy of Medicine, Paris, on 21st June of this year, it was affirmed that "chloroform injures, by exciting the nasal and pharyngeal mucous membranes, or by acting on the nervous centres." The solu-

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tion of cocaine applied to the nostrils, etc., appeared to be sufficient to prevent this in the greater number of cases.

Dr. Bietels, at St. Petersburg, before the Medical Society, read a paper on the use of a mixture of chloroform and oxygen. Less chloroform is required than by the usual methods of administration, consequently with less danger, no sickness follows, and the pulse is unchanged. The difficulty is to blend the vapor of the chloroform with the oxygen gas.

Dr. Wood, of Philadelphia, in his address at Berlin, says he found the hypodermic injection of digitalis produced a persistent rise in the arterial pressure, with an increase in the size of the individual pulse rate. In cases of weak heart where chloroform has to be administered, a dose or two at least of digitalis would greaty lessen the risk of cardiac collapse. The wonder is that this did not occur to us before. Dr. Wood also found the injection of a solution of strychnine into the jugular vein to produce surprising results. It caused a gradual rise of blood-pressure, and always caused an extraordinary and rapid increase in the rate and extent of the respiration. Every one knows the antagonism which exists between chloroform and strychnine. I should like, however, to have the dose and mode of giving this powerful restorative agent from a scientific authority.

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CHAPTER IV.

ETHER AS AN ANÆSTHETIC.

By Dr. Hartley, Leeds.

Dr. Hartley said that at the outset he must disclaim any intention of approaching the subject from an argumentative standpoint, and simply asked to be allowed to state some of the results of his experience in the use of anæsthetics during the past thirteen years, and especially the conclusions he had been led to from the use of ether. The leaders of the profession in Leeds, some sixteen or seventeen years ago, took up very seriously the question of the revival of the use of ether as an anæsthetic, with the view of ascertaining whether it was safer than chloroform, which up to that time had been the anæsthetic in general use in the town, and from which, in spite apparently of all precautions, deaths did occur now and then in unaccountable ways. Dr. Hartley then proceeded to state the opportunities which he had had of observing the various methods proposed for the administration of ether, and expressed his decided preference for the apparatus known as "Clover's Small Inhaler." During his earlier professional life he had kept notes of upward of 3,000 cases of ether administration, and this experience had since been continuously increased by the almost daily use of anæsthetics of one kind or another, the result being a strong conviction that in ether we have an anæsthetic that acts quickly, safely, and pleasantly to the patient, and of which it may be said that the larger one's experience of its use, the greater one's confidence in its value—a position which cannot be taken up by a chloroformist, who can never quite eliminate the possibility of an "accident" with his anæsthetic, even under the most favorable circumstances for its use. Still he would be sorry to use any anæsthetic without a serious sense of responsibility; and a distinction must always be drawn between the art and the

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science of the administration of anæsthetics. Quoting Dr. John Brown's words discriminating between "science" and "art," Dr. Hartley emphasized the necessity of acquiring, by constant experience and intelligent observation, the art of using anæsthetics properly, and proceeded to describe the mode of administering ether, illustrating his description by a diagram.

From one to two ounces of ether having been placed in the ether chamber of Clover's small inhaler, the face piece, with its valvular chimney, was attached to the chamber with the indicator pointing to 0, and so applied to the patient's face without the bag. In this way the patient could breathe freely into the outer air without inhaling any ether, and time was thus allowed for seeing that the face piece fitted closely and comfortably to the face, and that no air could enter by any crevice between the pad of the face piece and the cheeks, nose, or chin. When the patient had accustomed himself to breathe easily and freely through the apparatus, the bag might be cautiously applied during an expiration, but still without "turning on" any ether. The chamber was now very slowly revolved on the face piece to allow a little ether vapor to escape; but this at first must be in such small quantity as not to excite coughing. Dr. Hartley proceeded to describe minutely the various subsequent steps till the complete effect of the ether had been obtained.

Some rules and precautions to be observed in the use of ether were mentioned, such as:

1. As far as possible anæsthetics of all kinds were best given in the early morning, when the stomach had been empty for several hours and the body refreshed by sleep; but in any case let no solid food be taken for six hours, nor liquid food for four hours previous to the use of the agent.

2. Avoid giving alcoholic stimulation before administering ether, the effect of this being only to increase the narcotization and therefore the danger.

3. For a similar reason avoid the use of opium before or very soon after ether.

4. Watch the respiration, the dangers in respect of this function being (1) too deep carbonization of the blood and (2) mechanical obstruction. The delicate skin of the lobes of the ear was a good index as to whether the patient was becoming

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too deeply carbonized, and was always open to inspection. Obstruction to respiration might take place (*a*) from the simple falling back of the tongue; (*b*) from the presence of blood, food, or foreign bodies in the larynx; (*c*) from spasm of the glottis; (*d*) from the accumulation of frothy mucus in the larynx or lungs. If this latter occurred in marked degree, it was often due to the use of too large a percentage of ether vapor in the air breathed.

5. Watch the general character of the circulation, to note the effects of shock, hemorrhage, etc., or a tendency to engorgement of the right side of the heart.

6. Be prepared for any vomiting that might take place.

7. In recharging the inhaler, if this was necessary, beware of the presence or proximity of a naked light, the vapor being very inflammable.

8. Do not use more ether than is necessary to keep up the condition of complete anæsthesia.

9. Do not allow the patient's body to be uncovered more than was absolutely necessary for the conduct of the operation. Where a large surface had to be exposed, compensate by extra clothing, hot flannels, hot-water bags, etc., to the covered portions of the body.

As to circumstances which might or might not contra-indicate the use of ether:

1. As to age, he had given ether to people of all ages, from a child of 3 to an old lady of 86, to whom he administered it on three different occasions.

2. No class of cases seems specially prohibitive of ether (except where patients were suffering from acute inflammatory affections of the lung). He had used it in almost all possible operations of surgery, from the extraction of a tooth or the reduction of a dislocation to prolonged abdominal operations of all kinds, operations on the cranial cavity, and in numbers of cases to patients with chest diseases, such as pleuritic effusions, empyæma, abscess of lung, subdiaphragmatic abscess, and in one case to open a suppurating pericardium complicating empyæma.

3. Heart disease did not *per se* contra-indicate it. The general effect of ether in the circulation was as a stimulant. In aortic disease this was often beneficial; but if there was a tendency in the venous system to be overloaded and turgescent,

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as (*a*) in mitral disease, (*b*) when the right side of the heart was weak and dilated, or (*c*) from simple over-carbonization of the blood, then the administration of ether called for greater care.

4. Chronic drinkers were bad subjects for anæsthetics of any kind, but specially, perhaps, for ether.

The general conclusions he would draw as to the relative value of ether were these:

1. That ether is less dangerous than chloroform during operations.

2. That the danger of bronchitis or pneumonia setting in after operations is almost infinitesimal and quite preventible. He had never himself known a case of acute bronchitis or pneumonia after etherization with the form of inhaler he used, though such cases did occasionally occur when large quantities were almost poured into the lungs upon an open towel or sponge, and such a thing might happen if an undue proportion of ether vapor were mixed with the air breathed in any way, or the patient unduly exposed during or after operation.

3. That it is perfectly easy to calculate the proportion of ether that is being used by means of the graduation of the ether chamber and the index of the mouthpiece.

4. That when once complete anæsthesia is produced by ether, a very small proportion of ether vapor is sufficient to keep up the effect. One might almost say that the longer the administration is continued, the less additional ether is required. This is further illustrated by the fact that there is a stage of recovery from etherization in which, though partially conscious, the patient remains for a considerable time insensitive to pain, and an operation might be completed and the toiletting of the wound and applications of dressings borne without the patient exhibiting any signs of acute pain.

5. That in using ether everything depended on the skill and experience of the administrator, and that increased familiarity with its use gave rise to confidence not easily displaced.

6. That sickness was much less frequent and less intense after ether than after chloroform.

In two cases under his observation death had taken place during the administration of ether; both were cases of chronic obstruction of the bowels. The first was that of an old gentleman extremely exhausted by prolonged obstruction, the

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body tense and tympanitic; he had been taking for days previously little else but alcohol and opium. Colotomy was being performed, and before the bowel was opened, while the patient was still breathing quietly, the pulse suddenly failed, slight attempts at vomiting occurred, and nothing availed to restore the patient. This case was published some years ago.

The second was also a case of obstruction, with extreme distention of the body, and an attempt to relieve was only contemplated at the man's own urgent solicitation. Strictly speaking, etherization was not produced, as after a few respirations it was withheld, and the man died unrelieved.

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CHAPTER V.

ON PRIMARY CHLOROFORM SYNCOPE.

By Robert Kirk, M.D. Edin., F.F.P. and S. Glasgow,
Physician to the Dispensary for Diseases of Women, Glasgow Western Infirmary.

Mr. President and Gentlemen:—The subject of anæsthesia being one of almost boundless compass, I find it necessary to limit my remarks mainly to one aspect of the question. Even with this restriction I shall be obliged to deal with the subject in a very summary manner. For I have to lay before you what, if true, is a new principle in the action of anæsthetic agents, or at least a further extension or application of already known principles, which will be found to strike at the root of every question in anæsthesia, and to involve endless consequences which cannot be followed out in detail.

The subject of my remarks may be put in the form of the question: What is the cause, or causes, of the deaths that have actually happened from the inhalation of chloroform? In treating this question, I shall assume that so far all are agreed. I shall suppose that it is beyond dispute that the majority of deaths from this agent have taken place in the early stages of the inhalation, and in a somewhat sudden manner. I shall take it for granted that the term "chloroform syncope" is universally accepted as a correct designation of this form of sudden death.

Four points require to be considered in connection with the inhalation of the vapor of volatile substances. There is (1) the action, and (2) reaction of the substance which may be absorbed and pass into the blood; and there is further (3) the possible action, and (4) reaction of the vapor in the lungs, or on some part of the respiratory tract. Everything that can possibly come within the field of inquiry must be comprised under these four heads. It will be readily granted that only the first of these has engrossed the attention of inquirers;

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while the second may be set aside as having little to do with the question at issue, although there may be various effects, such as sickness, etc., which are worthy of consideration. With regard to the third point above mentioned, several observers and experimenters have inferred an action of the vapor on the extremities of sentient nerves distributed on the respiratory tract, but Professor Rutherford, of Edinburgh, was the first to discover that an influence of this kind exerted by such agents as chloroform, ether, or ammonia vapor, was capable of causing a marked retardation of the heart. From certain observations and experiments, Professor Rutherford arrived at the conclusion that this cardiac arrest was not due to direct reflex action, but to stimulation of the cardio-inhibitory fibres of the vagus by the state of the blood resulting from an arrest of respiration, for he observed that when such vapors were presented to the nostrils of a rabbit, it would hold its breath for thirty or forty seconds. Physiological difficulties meet us here which need not detain us. Observations on the effect of chloroform on the cat seem to show that there is some other influence at work than a semi-asphyxiated condition of the blood in inducing this cardiac inhibition. If it be admitted that it takes place, I think it will be convenient to regard it as a result of reflex mechanism, acting through the medulla. Further, it does not affect the question with which we are immediately concerned, where the impression on the respiratory tract is chiefly made, whether on sentient nerves distributed on the nasal or laryngeal membranes, or whether there may be an action in the pulmonary cells, and even on the blood itself, through the delicate partition formed by the thin walls of the capillaries and the pulmonary mucous membrane at this part. Dr. Macnaughton Jones and Dr. Newman have both observed that chloroform causes a retardation and stoppage of the circulation in the lungs, and the Glasgow committee have drawn the important inference that when the agent is administered by the lungs it may, as a direct local action, produce such a change in the walls of the vessels as to cause a retardation of the blood-current. If this retardation be greater in the lungs than in the systemic vessels in the early stages of inhalation, it must either be due to the vapor, or to the fact that the blood in the lungs becomes charged with dissolved chloroform in advance of the rest of the system.

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In the account of the ingenious experiments of the Glasgow committee, I have difficulty in deciding how much they attribute to the one or the other influence, but they expressly say that the anæsthetic vapor disintegrates blood-corpuscles and has a direct effect on the blood.

We have next to consider the possible reaction; the effect which may ensue when such an agent as the vapor of chloroform ceases to exercise its local action on the lungs and respiratory tract. No one, as far as I am aware, has taken this question into consideration, and my task shall be to show, and prove, if possible, to your satisfaction that such a reaction—a reverse movement of the reflex mechanism—does occur, and further, that here is to be found the solution of the enigma of chloroform syncope, and of all supposed anomalies in the action of chloroform.

What I have to set before you will be largely a restatement of views which have been already put into the hands of many of you in the shape of a pamphlet entitled "Chloroform Syncope." The theory there advanced as to the cause of this form of syncope may be formulated broadly somewhat as follows: The way to produce the primary syncope with certain anæsthetic vapors, more especially with such chlorine compounds as bichloride of methylene and chloroform, is to charge the air in the lungs with a certain proportion of the vapor of these substances, to allow it a short time to act, and then to let it escape by permitting the patient to breathe fresh air. The escape of the vapor under these circumstances is immediately followed by a violent reaction in the circulation, attended with a dangerous liability to syncope; this reaction, in fact, does lead to syncope in numerous instances, and the syncope so induced may prove fatal.

It will be at once apparent that this view of the early syncope does not exclude any other well-recognized source of danger from these or other anæsthetics. The danger of asphyxia or of an overdose remains, although our opinion as to the relative importance of each source of danger may be modified. My immediate object is to try to convince you that there is a serious source of danger from chloroform in addition to the latter two.

The theory here proposed is based on facts which have been recorded by various observers as occurring in animals, espe-

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cially the mouse, the cat, and the dog. It is further believed to be supported by the clinical records of forty years in the human subject, which show a certain analogy to the facts observed in animals, and which, indeed, of themselves seem inevitably to point to the inference that syncope does occur in the way indicated. It is further maintained, in behalf of this view, that although there were no evidence yet forthcoming to prove that this form of syncope had ever been attended with a fatal result in any animal, yet the conclusion that it has done so sometimes in the human subject is fairly warrantable, and, indeed, furnishes a more satisfactory explanation of the occurrence than any other that has yet been suggested.

Apart from all preconception, if possible, let us look at certain facts which have been observed in the cat. When this animal is made to breathe from 2½ to 4 per cent of chloroform vapor for not more than one minute, and is then allowed to breathe fresh air, a train of phenomena is to be observed, which for convenience of description and for the attainment of scientific accuracy may be divided into four stages. [The phenomena were observed by applying a stethoscope to the chest the moment the animal was taken out of the anæsthetic atmosphere and allowed to breathe the fresh air.] It was found that there was first a stage, lasting not more than ten seconds, during which the heart's action was at the rate of seventy to eighty a minute. There then occurred a sudden and almost instantaneous rise of the pulse rate to 200 a minute, and this lasted nearly a whole minute, constituting the second stage in the chain of events. This was immediately followed by an abrupt pause in the action of the heart, lasting sixty seconds, during which there was not the slightest audible action of the organ. Lastly, there was a fourth stage, of a somewhat singular kind. Almost immediately after this apparently complete pause in the heart's action, the animal lifted its head, rose up, and walked off as if nothing had happened. All these stages have to be noted, and their causation and significance ascertained; but before doing so, another observation made on the same animal has to be considered. It was found that if the anæsthesia was pushed to a certain depth before the cat was taken out of the chloroform atmosphere, the subsequent rise in the pulse rate and pause in the cardiac action above described did not occur.

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ow for the explanation of these four stages. The rate of ulse during the first brief stage of ten seconds clearly in- ed that such had been its rate when the animal was under chloroform, and observation could have further shown had the administration been continued for the next min- nder no possible circumstances would it have risen to 200. he explanation of the second stage is all-important. The derations which go to show that this sudden rise of the was due to the escape of the vapor from the lungs are llowing: First, Dr. Snow observed in the case of smokers inhale the smoke, that the vapor completely leaves the after three full inspirations of fresh air when the smoker iscontinued the process. Second, the same observer no- that when the inhalation of chloroform was discontinued, dor of the anæsthetic could hardly be detected in the h after three inspirations of air. Third, the rise in the pulse above mentioned, taking place in about ten seconds, sponds so closely with these observations of Dr. Snow, render it almost certain that the phenomenon was due is cause. Lastly, it seems to me impossible to find any cause under the circumstances for this extraordinary eration of the circulation, and the conclusion to be drawn all these considerations put together seems inevitable.

th regard to the third stage, the principal thing which I d like to prove to your satisfaction is, that before it oc- all the chloroform absorbed has left the blood. The fol- g are the arguments which support this conclusion: Nu- us reported experiments and careful observations appear ow that the elimination of chloroform never takes a r time than does the absorption of it by the lungs. Dr. has recorded a number of instances of 5, 10, or 15 min- inhalation in animals, and in a great majority of these lete recovery took place in a less period of time. True, are a few exceptions to this, but these are rare, and an ional after-effect cannot be held to prove that the sub- e is retained in the blood in these instances. I am in- d to believe that, from your own experience as chloro- ists, you will agree as to this view of the rapidity of the nation of chloroform. If you further consider the rapid lation which ensued when the cat was allowed to breathe ou must grant that the escape of the poison could not be

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delayed. If any further proof were needed that there was no chloroform in the animal's blood during the pause in the heart's action, it is to be found in the instantaneous recovery of the cat immediately afterward. Now, if these facts be as stated, here we may notice an important point. It follows, you will perceive, that the after-effects may be relatively twice as long after a brief inhalation of one minute as after a much longer one.

Now, gentlemen, I venture to call the pause in the cardiac action under consideration a syncope. During the cardiac arrest the animal was practically lifeless, and it must be evident that in a human being in the same condition the aspect of death would be complete. The acceleration of the pulse which preceded it must be regarded as a sufficient cause and explanation of it, and the liability to syncope of the human subject in similar circumstances cannot be doubted. A sudden rise of the pulse from 80 to 200 must be caused by something which has acted like a shock to the system. Let it be specially noticed that it is the very same effect as may follow the sudden removal of a stimulus which had been acting directly and powerfully on the cardio-inhibitory fibres of the vagus, when the heart is liable to bound away at a rapid rate. It is acknowledged to be a dangerous experiment to stimulate the vagus too strongly. We have but to see that the application and removal of an agent which stimulates the vagus through the reflex mechanism will be attended with the same results to understand the subject thoroughly. The effects following the removal of such a stimulus are said in works on physiology to be variable; but I am not aware if the importance of the greater or less degree of suddenness with which it may cease to act has been taken into consideration. Notice, further, the analogy, if not identity, with some of the effects produced by the application and removal of pressure from a large vessel. For, as observed by Marey in a horse, the compression of the abdominal aorta slows the pulse, and when the compressing force is suddenly removed and the blood permitted to rush into the area from which it had been previously shut off, a great acceleration of the pulse rate may occur, and the danger of syncope in the circumstances is well known. It is evident that if the after-effect in the case of chloroform is due to the escape of the vapor, it must be granted that the violent re-

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action proves that a powerful action of some kind was previously going on.

The view suggested, then, Mr. President, is simply that syncope may be induced in the same way in the human subject as in the cat, and that it may and does prove fatal. You will at once see how sharply this is to be distinguished from death from asphyxia or from an overdose. For if death ever results from such a form of syncope, it cannot be from asphyxia in that particular case. The one necessarily excludes the other; and, in fact, the respiration is more free and rapid than usual immediately before the syncope. But this does not imply that some degree of asphyxia may not previously have existed; on the contrary, it would be argued that if such were the case the reaction would be even more violent, for the sudden removal of an asphyxiating influence also leads to a severe reaction. It is needless to remark how widely different the same view is from the opinion that death has been due to an overdose in any given case, for this theory supposes that there is not a trace of chloroform in the blood or in the nerve centres when the syncope comes on.

There are some symptoms accompanying the inhalation of chloroform which it is important to notice in connection with the action of the vapor in the lungs or respiratory tract. These are: (1) The diminution of the *besoin de respirer;* (2) the degree of stupor induced in the early stages before the stage of excitement; and (3) the latter stage itself. What connection, if any, have these with any action going on in the lungs or respiratory tract?

With regard to the first of these, I incline to the opinion long ago expressed by Lallemand, Perrin, and Duroi, that it is due to the local action of the vapor, for it is very different from the character which the respiration assumes in deep anæsthesia. Dr. Snow noticed in the human subject that the patient might have no impulse to inspire for a whole minute; and he expressed the opinion that this was no indication of danger. And here I may mark my entire agreement with him in this view.

It seems to me very possible that the early stupor may be partly due to the same effect in the lungs. For it seems reasonable to suppose that any influence acting powerfully on the pulmonary circulation must be attended by reflex action,

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with some corresponding effect on the systemic circulation, for within certain limits of perturbation a sort of balance must be maintained between the two. And if so, the processes going on between the blood and tissues may be diminished from this cause, and so the stupor may be greater than would be produced were chloroform in the systemic circulation the only cause at work. Practically this is of no consequence; but there is one consideration here of paramount importance. This stupor is sufficiently deep to allow of a small operation, such as the extraction of a tooth, to be performed without pain, and there is much reason to believe that short operations are often performed when the anæsthesia is no deeper than this. Now, if there be any foundation at all for the advice of high authorities that safety is to be secured by giving plenty of it, it must be evident that their advice is not followed in these cases. And if there be any truth in the theory here submitted to you, it adds a powerful sanction to the injunctions of these authorities, for it follows, as a necessary consequence from it, that there is extreme danger of syncope from stopping the inhalation here.

The struggling stage raises a much more important question. It is probably of as much consequence to determine the cause of this as of the syncope itself. I incline to the opinion that there is some connection between it and interference of some kind with the pulmonary functions, and that in its causation there is probably a certain asphyxiating element. To enter into anything like a full discussion of this question would be quite impossible here. Let me indicate briefly a few points which seem of importance. In the first place, if causes operating in the lungs have anything to do with it, these might be made the subject of investigation by methods which have not yet been followed. The difference, if any, between various animals, in respect to the occurrence or severity of this convulsive stage, with chloroform and a few other anæsthetics, ought to be ascertained. There seems to be a marked idiosyncrasy in some individuals with regard to it. This fact, more especially, coupled with the contradictory statements of various experimenters, affords room for the suspicion that much remains to be learned about it in animals. Here great care should be taken to distinguish the effects produced during the actual inhalation of the agent, and those which ensue during

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ry when the process is left off at various stages. Let ound if there is not an increase in the severity of certain oms, and perhaps also a change in their character, when done. Let it be ascertained, if possible, whether sudden from an asphyxiating as well as from an anæsthetic is not attended with dangerous symptoms, and whether iffer from those which were observed while the animal ied in the asphyxiating atmosphere. And here I would pecial attention to a valuable experiment of the Hyd commission, which seems to point in a new direction, ight be more extensively applied to enable us to elimhe systemic action of any substance from the possible and reaction of its vapor on the pulmonary circula- allude to the experiment in which they injected chloroto the vein of an animal to prove that it does not parhe heart. You will see how easily this might settle the e about the relative danger of a small or a large dose of form. And if the large dose, as seems most probable, prove most dangerous, this would lead us to look for ution of the problem in some other quarter. But this d of investigation would do still more. It might deterow far the symptoms so produced differ from those by inhalation. If they should be found the same in would still remain to ascertain in what respects the ry differed or corresponded in the two cases. Would it nd that an animal taken suddenly out of an atmosphere a-chloride of carbon the moment it fell (as in the case ouse mentioned by Sir James Simpson), would either the spot, or, as in other cases, recover almost immediafter a minute or two of apparent death? It might be ained if the animal would sometimes die and sometimes r in these circumstances. Would sudden recovery from nt death ever take place if such a substance were ininto the blood in certain quantities?

me next request your attention to some observations on the dog, and which are still the subject of dispute. lasgow Chloroform Committee, by a few experiments, ost dexterous ever performed in anæsthesia, elicited a nteresting and important fact. They found in two ins in the same animal that a remarkable retardation of art occurred during recovery from chloroform; in one

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case two minutes, and in the other seventy seconds, after the inhalation had been left off. In the former instance the animal was said to have been in deep anæsthesia at the moment when the administration was discontinued; in the latter it is said that the agent was not pushed very far. This announcement seemed to take every one by surprise, with the exception of two individuals, who were quite prepared for it. I would first of all remark of these experiments that they teach an inestimable lesson. They show how difficult it may be to ascertain the facts. The same observation on the heart and blood-pressure had never been made before, not even by the London committee of 1864, in their series of most careful and accurate experiments. The explanation is that they had no suspicion that such an occurrence was anywhere to be looked for. Let me now indicate clearly the points in which I agree with the Glasgow committee. I agree, first, as to the fact that this retardation does occur (with fall of blood-pressure to zero, as recorded by them), and, second, that it occurs only in comparatively superficial anæsthesia, and not in deep narcosis. We are further in accord in the negative aspect of the explanation of the phenomenon—namely, that it is not due to asphyxia. It remains now to point out wherein I must differ from the committee. First, their observations were defective, inasmuch as they failed to ascertain all the necessary facts, for if the retardation of the heart in question was the third stage in a series of events, they ought to have found out the other stages. The fact that the blood-pressure was nearly normal before the sudden fall to zero proved that there were preceding stages, and even this additional fact elicited by the committee is of great importance, and refutes some erroneous conclusions of the Hyderabad commission. Second, I am bound to differ from the committee's statement that the dog was in deep anæsthesia in the first case when the inhalation was left off. If any dispute be here raised about the tests by which the depth of anæsthesia should be determined, the answer is that these authorities should themselves have furnished the criteria on which they relied. I cannot take time to discuss this now, but will only observe that if it should be found that when the anæsthesia is pushed to a certain depth before the inhalation is left off, any subsequent retardation of the heart of a serious kind will not occur, then I think it will be

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admitted that anything short of this ought not to be regarded as deep anæsthesia.

From the views suggested in this paper, you will see that I am compelled to differ radically from the committee as to the explanation of the occurrence under consideration. Indeed, they rather content themselves with making various suggestions, instead of arriving at any positive conclusion, and this gives me some room to hope that they may accept the view now offered. They suggest, for instance, that the effect on the heart might be due to "a reflex mechanism, irritation of sensory nerves of the outer openings of the respiratory passages stimulating the inhibitory centre of the vagi in the medulla, and thus retarding, or even arresting, the action of the heart." You see I suppose a similar mechanism, but my further explanation is that the agent which has acted on this mechanism has gone, and that the phenomenon observed is a stage in the reverse movement of this same arrangement. It cannot be maintained that the vapor is in the air-passages two minutes after the inhalation has been left off. The committee are further inclined to agree with the suggestion of the Hyderabad commission, that this after-fall of pressure is probably due to absorption of chloroform from the air-passages after the stoppage of the inhalation. Here it is obvious that the committee hesitate to decide between two possible causes. The valuable fact elicited by the committee that the pressure was previously nearly normal negatives the latter supposition, for, as the commission observed, the after-fall, due to absorption from the air-cells after discontinuance of the inhalation, is a continuous one. The hypothesis that there may be a dangerous dose of chloroform in the nerve centres under the circumstances, involves the committee in self-contradiction. For they say that these effects on the heart are only found in superficial anæsthesia, and it is a palpable contradiction to maintain that a dog may be in this condition, and yet under what appears to be a dangerous dose of the poison at the same time. Finally, their statement that this effect is due to some "capricious" action of the agent admits the failure of their attempts at explanation. And if any doubt remains, I appeal to further investigation, which could easily settle the matter when attention is directed to this particular point.

I must deal very shortly with the famous commissions

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which will render memorable the name of His Royal Highness the Nizam of Hyderabad. I have the greatest respect for the strong convictions of Surgeon-major Lawrie, and the intense earnestness and zeal which he has manifested. Dr. Lauder Brunton already stands on so high a pedestal in the profession that it would be out of place to say a word as to his scientific reputation. Nevertheless, there may be something which it has not been given them to discover, and so strong are my convictions that they have not been shaken, but rather confirmed, by the results of the commissions. Let me here emphasize strongly wherein I agree with the commission. My convictions are as strong as those of the commission that chloroform, when administered continuously by inhalation until deep anæsthesia is induced, or until death ensues, or when introduced gradually into a vein, never, under any circumstances, causes syncope. We are further in complete accord in the view that slowing of the heart by vagus inhibition, and the gradual paralyzing effect on the organ, is rather a source of safety than of danger. But here the agreement ends. For my conviction remains that there may be an effect produced by chloroform which all their ingenuity has failed to discover, and which, in fact, is illustrated, as it appears to me, by one of their own experiments.

In Experiment 40, after an inhalation of "only a few seconds," they found that there subsequently occurred a severe and prolonged after-fall of blood-pressure; that the heart had apparently ceased beating; and that, indeed, so serious was the aspect of the case that the dog was believed by all present to be dead. They compare this with cases in the human subject in which the patient is found to be dead some minutes after the inhalation has been discontinued. We may infer that the animal was apparently dead in less than two minutes after cessation of the inhalation, and that the pause in the heart's action commenced in one minute thereafter. Such seem to be the facts.

Gentlemen, it seems to me, after what has been already laid before you, that you may be left to your own choice in seeking an explanation of this. To the commission of course the supposition that it could possibly be due to any other cause than asphyxia or an overdose was inconceivable. But the insuperable obstacles to the acceptance of such an opinion should

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tell strongly in favor of any other proposed explanation. The case plainly contradicts the previous statement of the commission to the effect that when the inhalation is left off at an early stage the pressure gradually rises again and soon becomes normal, for undeniably it did not do so in this instance. Is it not clear that here the commission might easily have obtained the "Glasgow trace" had they only been clever enough to do so in so short a time? If the commission would furnish us with a few further details of this experiment and a full statement explaining how they reconcile it with their views, then the case might be noticed at greater length. Meanwhile it seems needless to go farther.

This experiment, gentlemen, I believe to furnish an excellent example of the primary syncope in a dog, and to correspond exactly with similar catastrophes in the human subject, and until both are satisfactorily explained the opponents of chloroform are justified in everything they have said against it. It is quite true, as maintained by Professor Wood, of Philadelphia, that it may "kill suddenly, unexpectedly, and without warning," that it is "treacherous," and its action frequently "anomalous and inexplicable." You see how, from the views advanced, it may fly off like lightning, and leave "not a wrack behind" but its terrible effect. It can only become safe when we know the secret of its power, and that there is nothing anomalous about it.

It is evident that if there has been a cause of death from chloroform even in the case of dogs which has never hitherto been suspected, previous results must often be unreliable. It may here be remarked that the statement I have elsewhere made, that "chloroform is five times safer than ether on the side of an overdose," applies strictly to the cat, and I would not venture to say so of a rabbit. I cannot take time to enter into the reasons which seem to justify the inference that the human subject bears more analogy to a cat than to a rabbit with respect to the action of chloroform. I am convinced chloroform is not so good an anæsthetic in a man as in a cat, but I am quite justified in leaving that impression on the reader, for I think that it is of pressing importance to get rid of the present scare about an overdose, which stands in the way of correct administration.

Before attempting to harmonize observations on animals

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with clinical records, there is one subject to which your attention might here be called. What is the state of the heart in chloroform syncope? Modern research has shown that some condition, different from paralysis, may be present. For forty years there has been known to pathologists a singular condition of the organ, for a knowledge of which I am indebted, and very deeply indebted, to two papers by Professor M'William, of Aberdeen, which seem of extraordinary interest and importance.[3] In this condition the heart, instead of being paralyzed and coming to a standstill in diastole, assumes an action of a spasmodic character. This takes the form of a "violent, though irregular and inco-ordinated, manifestation of ventricular energy. Instead of quiescence there is tumultuous activity, irregular in its character, and wholly ineffective as regards its results;" that is to say, there is a complete standstill of the circulation as long as this form of cardiac action continues. This cardiac disturbance has received the designations of "delirium cordis," "fibrillar contraction," etc., from pathologists. The most important points here to be noted are two. First, this state of the heart is more prone to occur, and is more dangerous, in the higher mammals than in the lower, and it may cause speedy death in a dog; second, the conditions that may bring about this cardiac irregularity are very variable, and may sometimes be apparently trifling. Professor M'William makes the valuable suggestion, in favor of which he makes out a very good case, that this may be the state of the heart in many cases of cardiac failure and sudden death in the human subject. The bearing of these facts on the proposed theory of chloroform syncope must be evident. Associated with the syncope, both before and after, there are spasmodic movements of the voluntary muscles, often of a peculiar twitching character. These would present an analogy, therefore, with the action of the heart, if the latter had at the same time passed into the state of delirium.

It remains to consider how far the clinical records correspond with the observations on animals to which your attention has already been directed. The "Lancet" has said, and said truly, that the two must be brought into harmony if possible. No journal has followed the subject with more attention and intelligence than the "Lancet," and to its appeal for more clinical details the reply may be made that these proved sufficient

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fifteen years ago to suggest to myself and a friend that there was something in connection with superficial anæsthesia of which we were ignorant, though at first everything was dark and obscure as to its nature. But let us see if the obscure does not now become simple. According to the view suggested, the greatest danger is incurred by administering chloroform for a minute and suddenly stopping short. The very first two deaths from the anæsthetic happened in this way. And, as if by a singular coincidence in connection with the present discussion, three deaths—one from each of the three most common anæsthetics, chloroform, bichloride of methylene, and ether—were reported on Saturday week last, all conforming to the same rule, and showing that even ether may cause syncope, and in the same way. It is expressly stated by the reporters of two of these cases that the fatality was due to syncope, the heart failing while respiration went on; while the small quantity of the anæsthetic used, even in the case of ether, is made the subject of special remark. It is urged, on behalf of the present theory, that all other explanations of these fatalities are failures. There is no chloroform in the blood of those who fall victims to the primary syncope; you may as well look for the lightning flash in the blood as look for chloroform there. I might go into much greater detail here.

The entire group of symptoms usually associated with the primary syncope are totally different from those produced by chloroform in the blood. The suddenness of the onset; the violent struggling and excitement; the gasping and snorting respiration, etc.—these taken together are wholly unlike those that would follow the gradual introduction of chloroform into the blood. But perhaps the most important point of all to be here noticed is, that a rapid running pulse has been sometimes observed to immediately precede the syncope (see a paper, showing an extensive knowledge of the subject, by Mr. Wilson, M.R.C.S. Eng., Anæsthetist to the Manchester Royal Infirmary, in the "Medical Chronicle" for April of the present year). I believe this rapid pulse to indicate that the reaction is in full swing, and syncope almost inevitable.

Administration.—The safe administration of chloroform is to be determined by our knowledge of its action. According to the present theory, the paramount indication is to keep

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up a continuous atmosphere of not less than 2½ per cent, until deep anæsthesia is induced, of which, perhaps, the best test is a certain short-drawn, somewhat labored and noisy, or even stertorous, state of the respiration. If this be done, no fault can be found with those who watch the pulse, or the respiration, or anything else. But if those who believe in small doses cannot accept this, then I fully agree with them that they must watch the pulse. More, I would suggest to them that their practice in this respect might be susceptible of improvement. For if there be any correspondence between the cat and the human subject, some acceleration of the pulse must precede the syncope. It seems very probable that the weak, fluttering pulse, so often mentioned, may be this rapid pulse. The first thing, therefore, these administrators have to watch for is—not the stoppage of the pulse, not the strength or weakness of the pulse, but whether there ever occurs a sudden increase in its rate. Manifestly, if the stoppage be the third stage in the train of events, the second must also occur. By determining whether this be so or not, these administrators might not only insure the greater safety of their patients, but would put the present theory to a very crucial test. I may further suggest to them that observation should be directed, not to the radial artery, but to the heart itself. A pulse of 200 is difficult to count at the wrist; indeed, I have known an experienced consultant say that the pulse was 90 when it was 180. It would seem to be quite practicable that an observer should be seated with a long double stethoscope to determine the action of the heart during the exhibition of the anæsthetic. Such an observer should record every phase in the action of the organ before safe anæsthesia is reached, and should particularly watch for the occurrence of any sudden acceleration of cardiac activity. Should such be found to occur, its possible cause should then be inquired into.

I have no fault at all to find with those who watch the respiration, but I cannot abate one jot of my conviction that there is no necessity to do so during the early stage when a patient may refrain from inspiring for a whole minute, owing to the temporary suspension of the *besoin de respirer*. But it is somewhat otherwise during the struggling or convulsive stage. This is much more severe in some individuals than in others, and I believe it varies much in different kinds of ani-

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mals. In the human subject I am strongly inclined to the opinion that it may always be overcome by simply continuing the anæsthetic, for it is the introduction of the substance in sufficient quantity into the blood which puts an end to it; but I confess that I could adduce no arguments on this point sufficient to convince others who may be of a different opinion. On the contrary, I am ready to admit that there may be certain animals, and even some individuals, who may be in danger of asphyxia at this stage, and in which it may be necessary to do something to facilitate the respiratory functions. Further, if any such means be combined with the continuance of the anæsthetic, it will be seen that according to the theory they cannot be other than beneficial, the object being to introduce the agent into the blood without any break in the process. And, if I may be allowed to say so, Mr. President, it was after a conversation with yourself I was led to modify some statements I have made on this matter.

Here I might refer to the way in which the chloroform in the blood in deep anæsthesia necessarily counteracts the effect which ensues when the vapor is permitted to escape at an early stage, but this can only be noticed. It is evident that when the former acts as powerfully on the heart, by what we may call direct inhibition, as the latter does through reflex mechanism, the sudden reaction alluded to is impossible. The reaction now depends on the elimination of the poison in the blood, and this is so gradual as to admit of a safe recovery.

This reflex nervous mechanism seems necessary to maintain a certain balance between the pulmonary circulation and that of the rest of the system, and it seems not improbable that the latter may be subdivided into a number of smaller areas whose circulation is similarly controlled. Indeed, this is recognized in standard works on physiology, but it would appear that all the consequences of this have not yet been fully worked out. According to this, when any disturbing influence is brought to bear on the pulmonary area, a note of warning is immediately sent round to the heart and systemic vessels which adapts them to the altered circumstances. And if the inhibition of the heart and lowering of blood-pressure which occur in the early stages of chloroform narcosis are largely reflex, one most important consequence must be noted. It follows that this effect must reach its maximum in about a

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minute or so, when it is probably nearly equal to the force which the chloroform in the blood will exert directly on the heart in deep anæsthesia. Hence, also, you see that this great initial lowering of pressure is not due to the small quantity of chloroform then in the blood, which, therefore, has not the dangerous power in this respect which it has been erroneously supposed to possess. For this reason it follows that in deep anæsthesia the further lowering of the pressure goes on at a very slow rate, in proportion to the increase of chloroform in the blood, and if observations made on a cat with the stethoscope are reliable, the rate of depression becomes almost infinitesimal.

The views suggested in the foregoing may be well illustrated by supposing a pendulum-like action in the vagus and the circulation. Hence you see that any force acting in one direction will cause a reverse movement in an opposite direction, and it is obvious that the latter movement will be in exact proportion to the intensity of the original force, and to the suddenness with which it ceases to act at the one extremity of the range of oscillation. This pendulum action is scarcely perceptible in health, but becomes marked in certain diseased conditions, in which the swings become wider. I regard the oscillations which may be produced by the inhalation of chloroform and other poisons as identical with the phenomena of "cerebral" and Cheyne-Stokes respiration; they are all wide swings of the same pendulum, and present numerous features in common. Hence it follows that in the gasping respiration so often described as following the chloroform syncope, the previously dilated pupil would be found again to contract, although I do not know whether any one has ever observed this.

It must be evident that if such be the cause of chloroform syncope, its treatment becomes a question of merely scientific interest. This also must depend on our knowledge of its etiology, and of the state of the heart during its apparent arrest. When the latter, in particular, has been ascertained, it will remain to determine the value of artificial respiration in this condition. I have long doubted its propriety, but cannot enter into the reasons which have induced me to suppose that lowering of the head, with patient waiting, would be the best treatment of chloroform syncope. This may seem startling enough,

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ou will grant that there can be no harm in rattling the of old theories and practice occasionally, to ascertain if are sound, especially when unlooked-for advances in edge have put new weapons into our hands for the pur-

ally, I would have you consider that if there is any in the views here advanced, it follows that the conclu- of the Hyderabad commission involve the subject in r darkness and confusion than existed in the days of ow and the London committee, and the position of the sion is worse than ever.

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CHAPTER VI.

APPENDIX.

I HAVE found it impossible, within reasonable limits of time, to take up the question of an overdose of chloroform. I should like, with your permission, to say only a word or two on this head. The most singular experiment bearing on the point with which I am acquainted is that of the Glasgow committee, in which, after an administration of seventy seconds to a dog, and in the course of which they say the animal received no overdose, there occurred a very rapid fall of pressure, with great retardation of the pulsations, till the heart almost ceased, while respiration continued. It is to me inconceivable that this should have occurred except from the inhalation of an unduly concentrated atmosphere, combined or not with some element of asphyxia. According to Dr. Snow, an atmosphere of 5 or even 6 per cent is quite a safe one, and will not lead to cardiac failure before respiration ceases. As far as the cat is concerned, I am justified in indorsing this most emphatically. The London committee obtained no such result as that of the Glasgow committee in their case, even with 10 per cent of the vapor. An atmosphere of 5 per cent is one of terrific and overwhelming potency, as the Glasgow committee could easily have ascertained by attempting to apply their own noses to it as I have done. It is certain that no such atmosphere is ever administered to the human subject. It is unnecessary to quote the results of the Hyderabad commission in their bearing on the same question, and I am surprised that Dr. Coats should have compared his case with Experiment 169 of the commission. Let us merely glance at the facts in the latter, without much reference to Fick and Ludwig traces. The dog was first of all anæsthetized, and fell down in 3 minutes and 25 seconds; in 15 seconds more it was placed on the table; after another minute and 37 seconds, more chloroform was given for the next 38 seconds, and more

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was again required in 40 seconds; and 40 seconds after this the artery was ligatured, chloroform being continued meanwhile 80 seconds longer; 16 seconds later the canula was inserted; more chloroform was again administered before connection with the manometer 3 minutes 4 seconds afterward; the entire process to this point having occupied 11 minutes 55 seconds. They then allowed the dog gradually to emerge, and after 2 minutes 35 seconds, there is the note in the margin "coming out," and it is almost immediately after this that they begin to push the chloroform "gently" and to take the tracings. Now, an important thing to notice here is that besides the depressing effect of the long administration, the animal was only showing the first signs of returning sensibility when the chloroform was again administered. This is definitely proved by the fact that in less than a minute it is noted "cornea insensitive." After this the pressure gradually fell till respiration stopped, but this interval of time was three minutes. Here it is noted that the needle in the heart was moving, and it did not stop till nearly four minutes afterward. The commission specially refer to this case, and rightly, as a typical illustration of the action of chloroform.

It must be evident that the factors which combined in the case of the Glasgow committee to produce trace C must have been of an extraordinary kind. It remains for them to find a parallel case to their own in the literature of anæsthesia, or to perform some further experiments on fresh dogs with the view of determining the effects of 5 per cent of chloroform vapor.

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THE

CLINICAL USE OF PRISMS;

AND THE

DECENTRING OF LENSES.

BY

ERNEST E. MADDOX, M.B.,

Late Syme Surgical Fellow, Edinburgh.

IX—18

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THE CLINICAL USE OF PRISMS,

AND THE DECENTRING OF LENSES.

CHAPTER I.

THE title of this little work indicates its chief features, but does not cover its ground completely. Its first object was to communicate a series of aids to precision in the use of prisms, worked out during several years, which it is hoped will be of some service in this difficult by-way of ophthalmic practice. They have, however, been introduced by a sketch of the simplest properties of prisms, and supplemented by a brief account of their chief clinical uses. For the sake of brevity, results are given rather than the geometrical processes by which they were obtained, while the mathematical formulæ are either suppressed or incidentally alluded to. When possible, home-made appliances are suggested in preference to expensive apparatus. Some failure in prescribing prismatic spectacles and combinations has perhaps arisen, in the past, from the lack of precise methods and tables to work by; encouraging exceptions must stimulate the desire to extend their number, but it will not be supposed that the precision aimed at in these pages is necessary in the majority of refraction cases. It is chiefly anomalies of convergence, faulty tendencies of the ocular muscles, and the needs of the increasing neurasthenic class of patients that are kept in view. In these last cases, spectacles cause discomfort, however perfectly refraction may be corrected, unless the lenses are also suitably placed in respect of convergence, and sometimes even then, for a time.

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PRISMS.

A.—Simplest Properties of Prisms.

1.—*Geometrical Properties.*

In ophthalmology, as in optics, the essential thought of a "prism" is a wedge of transparent material, having at least two plane faces parted by an angle.

This angle may be of any size, and is spoken of as the "angle of refraction."

In Fig. 1 we see the prominent features of a rectangular prism—the kind most commonly used by students of optics.

Fig. 1.—A Rectangular Prism.

The "refracting angle" is *d a c*; the plane faces, *a b d e* and *a b c f* are named "refracting surfaces," and the line *a b* in which they meet, or would meet if prolonged, is called the "edge."

The sections *a d c* and *b e f* being made in planes perpendicular to the refracting surfaces, are named "principal sections." The remaining surface *d c e f* is the "base."

When prisms are designated "square," "rectangular,"

Fig. 2.—The same Prism in Section

"circular," and so forth, it is of course understood that these expressions do not, as indeed they could not, apply to the angle of the wedge, but to the scope of the two refracting surfaces. Clinical prisms are almost universally circular to admit of their insertion in the same trial frame as the lenses: the de-

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sign in Fig. 3 shows how a circular prism is related to, as though it were cut out of, a rectangular one.

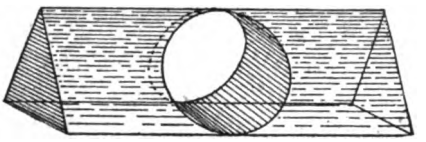

FIG. 3.—A Hypothetical Illustration to show the Relation of a Circular Prism to a Rectangular one.

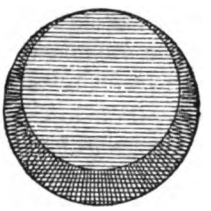

FIG. 4.—A Circular Prism.

2.—*Optical Properties of Prisms.*

When rays of light traverse a prism they undergo "refraction," by which they are bent from their previous course and emerge in a new direction. In Fig. 5 this is illustrated. An "incident ray" (*e*) is seen to impinge on the face *A C*, but here in passing out of the less refracting medium—air—into the more refracting medium—glass—it is bent toward the

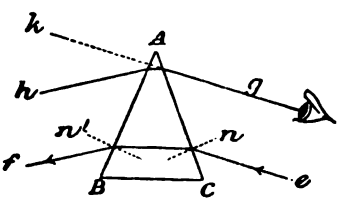

FIG. 5.—Refraction through a Prism. Incident ray, *e*; emergent ray, *f*; incident ray in opposite direction, *h*; emergent ray, *g*.

dotted line *n*, which, being perpendicular to the surface, is called the "normal."

The ray, after traversing the prism, emerges from the other face *A B*, but since, while doing this, it is now again entering the less refracting medium, it is bent away from the normal, *n'*. The ray thus experiences a double deflection, the combined effect of which is that it is turned from its previous

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course through an angle about half that by which the refracting surfaces are separated. It is important to notice that since the deflections take place only at the surfaces, the thickness of the prism, or the distance from its edge at which it is traversed by the ray, does not affect the result, provided the angle between the surfaces remains unchanged. Thus in the figure, the rays *g h* and *e f* are equally deflected, though the former is much nearer the edge of the prism than the latter: the greater the angle (*B A C*) between the faces, the greater is the deflection of both rays. (For the index of refraction, the law of sines, etc., the reader is referred to the text-books. Their study is not essential for our subject.)

Minimum Deviation.—When the points of incidence and emergence of a given ray are equi-distant from the edge of the prism, as in the figure, the ray is said to traverse the prism in the "direction of minimum deviation;" or, to put it another way, the prism is said to be (in reference to the ray) in its "position of minimum deviation." By this it is meant that the ray under these conditions suffers less total deviation than if it passed through the prism in any other direction. (This is beautifully defined, in an experimental way, by Deschanel: "When a beam of sunlight in a dark room is transmitted through a prism, it will be found, on rotating the prism about its axis, that there is a certain mean position which gives smaller deviation of the transmitted light than positions on either side of it: and that when the prism is in this position, a small rotation of it has no sensible effect on the amount of deviation. The position determined experimentally by these conditions, and known as the position of minimum deviation, is the position in which the ray passes symmetrically.") With weak prisms, however, and only slight departures from the "position of symmetry," the difference is so trifling that it may be neglected in ophthalmic practice.

Dispersion.—By dispersion, or "chromatic aberration," is meant the breaking up of light into its constituent colors. It is a property possessed in greater or less degree by all prisms, since the differently colored rays, being unequally refrangible, are deflected through different angles, the violet rays (or more correctly the lavender, if they are really part of the spectrum) experiencing the greatest deflection, and the red the least, while the paths of the rays of intermediate colors are spread

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out between these two extremes. The whole solar spectrum can thus be received upon a white screen arranged to intercept a pencil of light which has traversed a strong prism. This property of dispersion, so valuable in spectrum analysis, and to which also are due the various tints of dawn and sunset, is a serious disadvantage in the ophthalmological use of prisms, from the colored margins it appears to give to objects, and the want of definition it occasions, just in proportion to the strength of the prism used.

It is only fairly weak prisms, therefore, that can be clinically employed with much advantage. The dispersive power of crown glass is so much less than of flint glass that it is invariably employed for clinical purposes. Achromatic prisms can be made by cementing together two prisms, one of crown, the other of flint glass, with the apex of one to the base of the other, since the ratio between the refractive and dispersive power is different in the two kinds of glass. (The dispersive power of crown glass is to that of flint glass as 33 to 52; whereas the refractive power is about as 31 to 32, though it varies greatly with different specimens, and must be determined for each.) But though suggested long ago, such combinations have been precluded by their weight from clinical use.

3.—*Clinical Properties of Prisms.*

The only clinical use of prisms is to change the direction of the rays of light, but this is fruitful in its secondary applications. They always produce an optical illusion; in other words, they make objects appear in a different position from that which they actually occupy.

Clinical prisms, as we have seen, are generally circular; their thinnest point is called the "apex" and their thickest part the "base."

An imaginary line between the apex and base is called, for convenience, the "base-apex line." All objects viewed through a prism appear displaced in a direction parallel to this line, and always toward the edge, by which is meant the line in which the two plane surfaces would, if prolonged, meet. It is customary to say that objects appear displaced toward the apex, an expression which, if a little less correct, is still very convenient, provided it is not misunderstood. The accompany-

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ing diagram (Fig. 6) will make it clear, and a glance back to Fig. 3 may assist in understanding what is meant by the "edge," for since the refracting surfaces of the rectangular prism are extensions of those of the circular one (supposing the latter to be in place) the line in which they meet is the "edge," of both prisms. Thus, to give an experimental exam-

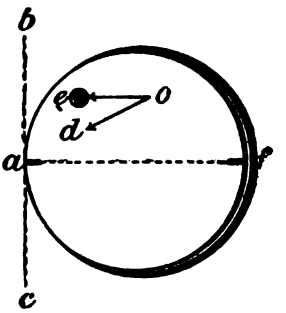

FIG. 6.—To show how an Object at *O* appears Displaced, not in the Direction *d* toward the Apex *a*, but in the Direction *e* toward the Edge *b c*, and Parallel to the "Base-apex Line," *a f*.

ple, if we look at a vertical line on the wall, as *x x* in Fig. 7, through a prism held several inches from the eye, with its apex at *a*, we observe that the part of the line seen through the prism appears displaced toward its edge. The reason is apparent from a glance at Fig. 5 (on p. 269), where the ray *h g* from an object at *h* is deflected by the prism toward its base,

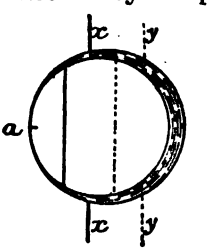

FIG. 7.—To show the Apparent Displacement of Lines through a Prism.

so that it appears to come from *k*; or, in other words, it enters the eye in a direction as if it came from *k*, so that the object is mentally projected there. Since the refracting surfaces of any prism are of necessity inclined to each other by the same angle in every part of their area, it follows that the apparent displacement of an object is equally great, through whatever part of the prism it is viewed. Thus in Fig. 7 the lines *x x*

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and *y y* appear equally displaced. By this property prisms may be at once distinguished from lenses, or combinations of lenses and prisms. With a lens, lines viewed through different sides of its optical centre appear displaced in opposite directions; with a concave lens, both lines appear deflected toward the centre, and with a convex one both away from it. As regards direction of displacement, the edge of a convex lens is well known to act like a prism with its edge outward, while that of a concave lens acts like a prism with its edge inward, though in each case the degree of displacement increases with each approach from the centre to the edge. By viewing a distant line through an unknown lens, hard by its edge, and opposing to it lens after lens from the trial case

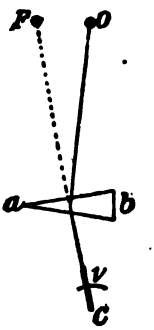

FIG. 8.—A Prism before an Eye, in Monocular Vision.

till the line appears unbroken, the strength of the unknown lens can be determined to within a quarter of a dioptre, and the same principle is utilized in the now general practice of viewing some object through a moving lens, to observe whether the apparent movement of the object is with or contrary to that of the lens, which in the former event is concave, and in the latter convex.

To return to prisms, we have seen that they appear to displace objects in the direction of their edge. Since an eye tends to be diverted toward the (apparently) new position of the object, it follows that the line of fixation is also displaced toward the edge, and in working with prisms these two clinical properties are all that need be remembered. Fig. 8 illustrates both: a prism is placed before one eye, the other being covered, and it is evident that the object *O* appears displaced

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to *F*, and the line of fixation *v* is diverted from *O* to *F*—both in the direction of the apex *a*. The line *F C* in which the false image lies is called the "line of projection," since it marks the direction in which the picture on the retina is mentally projected.

With binocular vision, as in Figs. 9 to 12, the conditions are not quite so simple. In all these figures the ruled lines show the actual course of the rays from the object *O*, and the dotted lines are the lines of projection. They almost explain themselves: in all it will be seen that the object appears displaced toward the edge of the prism, though in some (Figs. 9 and 10) there is diplopia, since the object is seen in its true

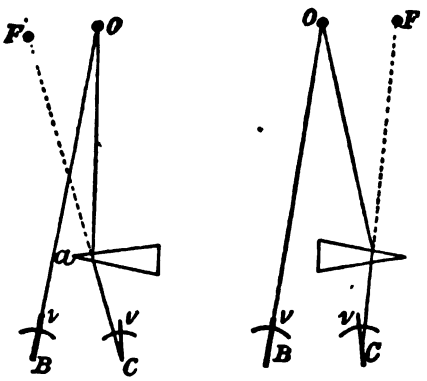

Fig. 9. Fig. 10.

Figs. 9 and 10.—Prisms not Overcome, and therefore Causing Diplopia.

position *O* by the unclad eye at the same time that its false image *F* is seen by the other in the direction of the edge of the prism, which is directed inward in Fig. 9, and outward in Fig. 10. In Figs. 11 and 12 there is no diplopia; it has been corrected by the desire for single vision, and the two images are fused into one. Still, the united image appears in a false position, though the angular displacement of the line of projection *p p*, is only half that in the previous examples. The diplopia is corrected by a rotation of the eye so as to receive again upon its fovea centralis the picture of the object which the prism had dislodged to another part of the retina; thus in these two figures the line of fixation *v C*, has come to be in line with the rays of light coming through the prism from the object, and since both eyes receive a picture on the fovea,

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vision is single. In Figs. 9 and 10 there is no definite line of fixation for the right eye, since it is fixing nothing, and it is clear that the picture must fall on the retina away from the fovea, though with every effort to unite the images and bring the axis of vision *v* C, into the line of the rays, the position of the picture on the retina will vary, and the images will move toward or from each other.

Prisms set with their edge inward as in Figs. 8, 9, and 11, are called adducting prisms, and those with their edge outward as in Figs. 10 and 12, are called abducting prisms. The

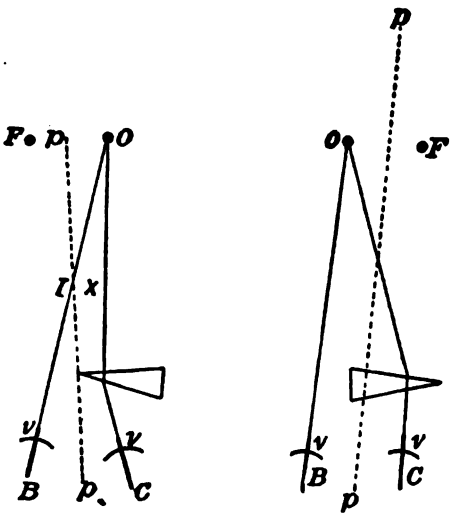

Fig. 11. Fig. 12.

Figs. 11 and 12.—Prisms Overcome; no Diplopia.

former, when vision is binocular and without diplopia, by increasing the necessary convergence of the eyes, make objects appear nearer than they actually are, and the latter make them appear too far away. Thus in Fig. 11 the real object *O*, appears to be at *I*, where the two lines of fixation intersect. (Exceptions to this I have pointed out in "Journal of Anat. and Phys.," vol. 21, p. 21, but it is not desirable to enlarge on it here, or to enter deeply into the physiology of convergence, which would need a book to itself.) As Hering has shown, convergence occurs as if for the cross and both eyes are turned toward *I* by an impulse of the conjugate innervation which turns the two eyes to the left: it is the mental cogni-

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zance of this effort which imparts corresponding obliquity to the line of projection, *p p*. The prism, therefore, does not test the strength of either rectus, since convergence is a single action affecting both eyes equally, but it estimates by how much convergence can be made to exceed accommodation, or *vice versa*. The two functions are so confederate that there are limits to the amount by which either can be increased or diminished without the other. Prisms should be placed as close as possible to the eye, then their angles of deviation nearly express the diplopia, or corrective squint, they occasion, or the sum of both if both are present.

One of three events therefore may happen on placing a prism before an eye. (1) If vision is monocular, one false image is seen, whose distance from the actual position of the object is unvarying, and dependent entirely on the deviating angle of the prism, Fig. 8. (2) With binocular vision the prism may be too strong to be overcome, in which case there is diplopia with an inconstant distance between the images, which approach each other spasmodically with every effort to overcome the prism. (3) The diplopia may be overcome and the object appear single, though its position in space is misjudged through an angle practically equivalent to half the deviating angle of the prism.

B.—Marking the Apex.

Circular prisms, as usually sold, have their apex and base indicated by a slight scratch from a diamond. It is to be feared, as we shall see, that experimental work with prisms has hitherto been frequently vitiated by the prevalent inaccuracy in marking the apex—a defect to which, as far as I am aware, no attention has yet been called. An obvious consequence of inaccurate marking is that prisms may not be quite squarely set in the trial-frame; yet the slightest departure from precision in this particular alters the experiment. For example, if it be desired to set a prism of 15° d, with its edge exactly in or out, an aberration of the base-apex line through only a ninetieth part of a circle has the effect of not only lessening in a trifling degree the desired horizontal deflection which it is the aim of the prism to produce, but also of introducing a new and unsuspected vertical deflection of more

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than 1°. This is shown in Fig. 13, where the actual flame *o*, appears displaced to *a* instead of *b*—the true base-apex line being *o a*, though the prism is marked as if it were *o b*; hence *a o b* is the angle of error in setting the prism. At twelve feet distant the flame would appear more than two and a half inches higher than it really is. (The unsuspected vertical deflection of a ray of light by a prism whose base-apex line is supposed to be horizontal, or the unsuspected horizontal deflection by a prism whose base-apex line is supposed to be vertical, may be found in any particular case, by the following formula, sin. x = sin. D + sin. r; where x is the angle required, D is the deviating angle of the prism, and r the angle of accidental rotation from exact rectitude.) Now it is well known that vertical diplopia greatly embarrasses the neuromotor apparatus, and in some persons it cannot be overcome at all

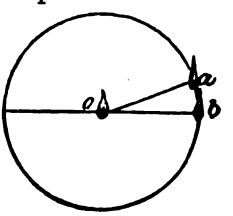

FIG. 13.—Showing the Effect of Setting a Prism by a Wrong Mark. The marked apex is toward *b*, and the true apex is toward *a*, so that the flame *o*, which should appear at *b*, appears at *a*.

when greater than one degree, so the prism in the previous experiment may be put down with the verdict that it is too strong to be overcome, when really it is the concomitant accidental vertical diplopia created by it which cannot be overcome, or at least the effect of which vitiates the experiment.

If any surgeon will take the trouble to test the marks upon his own prisms he will find how frequently they are misplaced; the test can be easily made by the following simple device. Draw upon a sheet of paper two fine straight lines intersecting each other exactly at right angles as in Fig. 14, and hold the prism vertically above them so that on closing one eye the supposed apex apparently coincides with the point of intersection of the lines, and the prism only appears to touch the horizontal line at that point, and does not in the least overlap it on either side. If the prism is correctly marked, the vertical line appears unbroken as in Fig. 14, but if not, the part of the line seen through the prism appears disjointed from

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the rest, and displaced as in Fig. 15, toward the side of the real apex. It only remains to rotate the prism till the unbroken appearance of Fig. 14 is gained; then the point on the prism's edge in apparent coincidence with the point of intersection of the lines may be regarded with confidence as the real apex. The cross-lines can be permanently provided on a large card suspended upon the wall of the consulting-room in connection with that for testing the deviating angle, and they will be found useful for many purposes. For opticians it is suggested to have a diamond half imbedded in a plate of glass fixed horizontally above cross-lines similar to those already employed, or merely above one vertical line if the horizontal one be graven on the glass. The diamond would be brought in correspondence with the point of intersection of

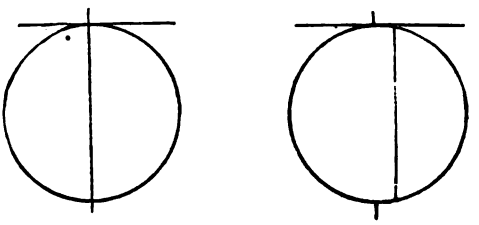

FIG. 14. FIG. 15.

FIG. 14.—Mode described for Testing the Apex of a Prism.
FIG. 15.—Appearance with a Badly-marked Prism.

the lines, so that after finding the apex a slight push of the prism would mark its true position.

A still better form of the apparatus would be one with two shoulders cemented on the glass plate, to grip the edges of the prism instead of using a horizontal line, and to have the diamond held in a sliding arm to make a perfectly straight scratch. Greater distance of the prism from the vertical line magnifies the phenomenon, and makes the test more delicate. The true base of a prism can be found and marked in just the same way as the apex, and if prisms thus manufactured come into use, one of the many causes of experimental inaccuracy will be removed.

C.—PRISMETRY.

The name prismetry will be given to the measurement of the deviating angle of prisms; that of goniometry being already applied to the measurement of their physical angles.

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For measuring the refracting angle of a prism (that is, it will be remembered, the angle by which its refracting surfaces are parted), several instruments exist already, named goniometers, of which it is easy to make an adaptation suitable for ophthalmological prisms. [A home-made goniometer for clinical prisms can be easily made by mounting a prism-holder (a lens-holder will do) by a pivot on the centre of a small circular dial of wood; a long-hand of a clock is fixed to the upright pivot of the prism-holder, and the dial is graduated with degrees, or simply fitted with a common protractor as found in any box of mathematical instruments. The procedure is as follows: Place the prism to be tested in the holder, with base-apex line horizontal, and support the whole instrument on a table or stand opposite the window. Now set the indicating clock-hand at zero of the scale, and rotate the dial itself till a vertical sash of the window, as seen reflected from one face of the prism, appears (to an eye placed between the prism and the window, but lower than the former) exactly to coincide with a chosen spot or line on the opposite wall. Now leave the dial *in statu quo*, but rotate the clock-hand till the same window-sash is seen reflected from the other face of the prism, and is brought in line as before with the other two points. The index-hand will now be found pointing to the degree on the scale which describes the refracting angle. The only precaution necessary is to be sure that the observer's eye occupies the same position in making the two observations. Another way to measure the refracting angle is to adapt the legs of a pair of compasses to the two faces of the prism, then either use a protractor, or measure the distance between the points of the legs, by placing them on a millimetre rule. If the length of the legs is known, the angle required is found by dividing the length of the legs by half the distance between their points, and doubling the angle of which this is the sine. But the dial mode first described, or that with the protractor, needs no calculation. Having thus, by one or other way, measured the refracting angle A, we may measure the deviating angle D, by one of the modes given in the text, and then ascertain the refractive index of the glass of which the prism is composed by dividing the sine of half the sum of the two angles by the sine of half the refracting angle.

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$$\text{Thus:} \quad \mu = \frac{\sin. \frac{A + D}{2}}{\sin. \frac{A}{2}} \Bigg]$$

But these acquaint us only with the geometrical—not with the optical—properties of prisms; what the surgeon needs alone to know is not their refracting angle, but their deviating power over a beam of light. It has been noticed already that this "angle of deviation" is in each case about half the angle of refraction—with weak prisms rather less, and with strong ones rather more, than half (Donders)—but apart from this difference, and from the uncertainty of always in practice insuring the exact position of minimum deviation, the refractive index of different specimens of crown glass varies so much

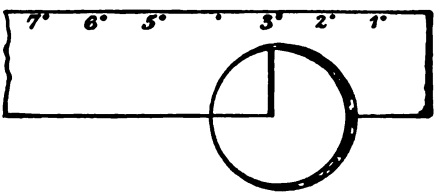

Fig. 16.—The Author's First Mode of Prismetry.

that, as Donders ("Accommodation and Refraction of the Eye," Sydenham Society, p. 132) truly observed of the angles of deviation: "If we wish to know these accurately, it is necessary to determine the deviations for each glass separately." To do this with certainty and ease two simple methods were contrived some years ago, one most suitable for the student or surgeon, the other for the optician. The first can be made without expense, and employed without artificial light. It consists simply of a strip of cardboard suspended horizontally near the right-hand corner of a consulting-room wall, and at such a height from the floor as to be about level with the eyes of the observer. On the wall adjacent to that on which the cardboard is hung, and which enters into its right-hand corner, a permanent mark is made at the distance most generally convenient for making the observations. The card itself is marked, as in Fig. 16, in degrees (really, of course, in tangents of degrees. A paper scale of this kind was affixed in May, 1886, to the wall of Messrs. Pickard and Curry's work-

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shop, having been sent them by the author for measuring the deviating angles of their prisms) for this distance. All that is necessary to measure the deviating power of a prism is to hold it opposite the already mentioned mark on the wall (the distance of the observer's eye behind the prism does not affect the result in any way) with its apex to the left, and so that its upper border appears just beneath the line of degrees as in the figure. The vertical border of the card appears necessarily displaced toward the edge, and points upward to the number which expresses in degrees, at once and without calculation, the required deflecting angle of the prism. In the figure this is seen to be 3°. One precaution alone needs to be observed; if the lower edge of the cardboard seen through the prism appears disjointed from the level of the rest, as in Fig.

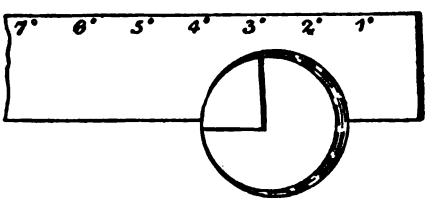

Fig. 17.—A Prism Not Held Truly.

17, the apex of the prism is not pointing exactly to the left, but is either too high or too low, according as that part of the broken line seen through the prism is above or below the remainder. A slight rotation is therefore necessary to correct this, till the lower border of the cardboard appears at one level, as in Fig. 16.

The distances between the degrees of the card depend, of course, on the chosen distance at which it is found most convenient to hold the prism, and this would depend on the size of the room and other conditions. The distance of the observer's eye from the prism is of no consequecne; any student can easily mark a piece of cardboard for himself from the accompanying table, which gives the distances from the right-hand border of the card at which the several degrees are to be marked upon it, assuming the prism to be held at a uniform distance of six feet (first column), or two metres (second column).

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TABLE I.

For marking a card in tangents of degrees at 6 ft. (column A); or 2 metres (column B).

	A	B		A	B
1°	1.25 in.	3.49 cm.	9°	11.4 in.	31.29 cm.
2°	2.5 "	6.98 "	10°	12.6 "	34.78 "
3°	3.7 "	10.467 "	11°	14.0 "	38.16 "
4°	5.0 "	13.95 "	12°	15.3 "	41.58 "
5°	6.3 "	17.43 "	13°	16.6 "	44.99 "
6°	7.57 "	20.9 "	14°	17.9 "	48.38 "
7°	8.84 "	24.37 "	15°	19.3 "	51.76 "
8°	10.12 "	27.83 "	16°	20.64 "	55.13 "

For a different range, the measurements would of course differ in proportion; thus, should it be decided to always hold the prism at three feet, the distances would be half as great

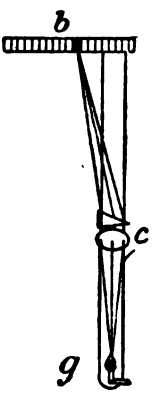

Fig. 18.—Second Mode of Prismetry.

as in the table; if at twelve feet, twice as great. It is clearly an advantage, when a patient enters with prismatic spectacles, for the surgeon to be able to ascertain their strength without calculation or artificial light; and such spectacles will no doubt come into more frequent use, since convergence is becoming more precisely studied.

The second method affords a much prettier demonstration of the deviating angle of prisms, but needs a more definite illumination than diffused daylight. It consists of a strip of wood, as in Fig. 18, laid flat on a table or counter with a shorter strip *b*, fixed at right angles to its further end in such wise that while horizontal in its length its plane is vertical. Upon the longer strip a cylindrical lens *c*, is fixed erect, with its axis vertical, so as to throw a line of light from the gas

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flame *g* upon the strip *b*, which is marked in degrees (strictly speaking, "in tangents of degrees"), so that a prism held before the cylinder *c*, with its base-apex line horizontal, at once makes the bright line move to that degree which indicates the deviating angle. The flame can either be fixed to the main strip or be quite separate, and it is well, if the light is poor, to combine with the cylindrical lens a spherical one of such strength that the source of light shall be at its principal focus. [A modification in this method was suggested by Messrs. Pickard and Curry (to whom it was given about the same time as the other), viz., to curve the graduated scale into an arc, in order to save the calculation of tangents in its manufacture. The following foot-note appeared in an essay at the time: "Since the only clinical use of prisms is to deflect the rays of light which traverse them, and since the index of refraction varies with the different specimens of glass, the usual method of marking prisms is not very satisfactory for exact purposes. After consultation with Messrs. Pickard and Curry, they have now a quick method of testing the declinating angle of their prisms" ("Journal of Anatomy and Phys.," Maddox, October, 1886, p. 32). It will be seen, however, from this extract, that it was only for "exact" (*i.e.*, physiological and experimental) purposes that the need was thus expressed for the marking of prisms with their deviating angles. Dr. Jackson's subsequent proposal has prominence given to it in the text, because it embraces all prisms used in ophthalmology: its acceptance by Messrs. Pickard and Curry was due to the energy of Dr. Landolt, last year.]

An important proposal has been made by Dr. Edward Jackson, of Philadelphia, that all ophthalmological prisms should be marked with the angle by which they deviate rays of light, and, in consequence, it was recommended by a committee of the American Ophthalmological Society in September of the year 1888, that—

(1) Prisms ought to be designated by the number of degrees, "minimum deviation," they produce.

(2) Where intervals of less than one degree are desired, half degrees and quarter degrees should be used.

(3) To indicate that degrees of deviation are meant, the letter *d* should be used; thus prism 2°*d* will indicate a prism that produces a minimum of two degrees.

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The committee consisted of Drs. E. Jackson, S. M. Burnett, and H. D. Noyes, and their decision was conveyed by Dr. Landolt to the Heidelberg Congress in the same year.

It is almost certain, therefore, that prisms thus marked will soon come into general use, and they will greatly simplify calculation.

Possibly, however, if I may be allowed to suggest it, a still better plan would be to have all prisms marked with metre angles and their fractions, so as to correspond with lenses in the trial case, a metre angle being the chosen unit of convergence just as a dioptre is that of accommodation. The only disadvantage is that the metre angle is an inconstant quantity. It is the angle by which each eye has converged from direct parallelism while fixing a point in the median line at the distance of one metre. Its size, therefore, depends on the distance of the centre of rotation of the eye from the median plane, for it is this line which subtends the angle. Its average in adults is taken by Nagel as 1° 50′. It is useful to have a scale, as in Fig. 16, marked in metre angles according to this average, as well as a scale marked in degrees, so that by holding any prism up to view, its strength in either unit can be seen without calculation.

In Table II. the measurements are given by which such a scale can be made by any one for himself, on a strip of paper or cardboard.

TABLE II.

For marking a card to be used at the distance of two metres, for telling the strength of a prism in metre angles.

Metre Angles.		Metre Angles.	
0.5	3.2 cm.	5.0	32.3 cm.
1.0	6.4 "	5.5	35.6 "
1.5	9.6 "	6.0	38.9 "
2.0	12.8 "	6.5	42.2 "
2.5	16.0 "	7.0	45.6 "
3.0	19.3 "	7.5	49.0 "
3.5	22.5 "	8.0	52.3 "
4.0	25.7 "	8.5	55.8 "
4.5	29.0 "	9.0	59.3 "

D.—Planeness of Surface.

Little need be said of this, though in buying prisms it is well to examine the planeness of the important "refracting surfaces;" it is often very defective, and this slightly contrib-

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utes to the difficulties of using prisms. Moreover, since plane faces are rarely ground with the same accuracy as spherical ones, it is better when combinations of lenses and prisms are prescribed to have both surfaces spherical instead of one spherical and the other plane, except when very strong lenses are employed, in which case they are better sometimes plano-convex to diminish spherical aberration.

E.—Adjustment of Prisms in the Trial-frame.

If the apex and base of a circular prism are correctly marked, there is no difficulty in setting it with the base-apex line either exactly vertical or horizontal. But if there should be any doubt about their precise position, the following simple expedient will at once enable us to detect and correct any

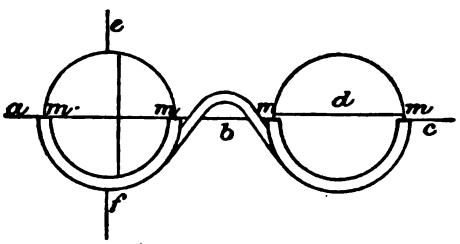

Fig. 19.—Two Prisms in a Trial-frame.

malposition. If the base-apex line is wished to be horizontal as with the right-hand prism of Fig. 19, hold the trial-frame a few inches from the eyes, so that, as represented in the figure, the upper extremities *m m m m*, of its sockets coincide to all appearance with a horizontal line *a b c*, upon the wall: if this line upon the wall appears continuous, the prism is correctly set, but if that part of it visible through the prism appears disjointed from the rest as *d* in Fig. 19, the apex is either too high or too low, according as the apparent disjointment is upward or downward. In the figure the apex is too high and the correction is therefore easily made by rotating the prism so as to depress the apex till the line appears continuous. If the base-apex line is wished to be vertical, as with the left-hand prism of the same figure, the horizontal line on the wall must be supplemented by another at right angles to it, as *e f* in the figure: again adjusting the frame as before to the horizontal line of sight, the rectitude of the prism is now indicated

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by the appearance of the vertical line. If its course appears undeviating the setting is faultless, but if, as in the figure, the part seen through the prism is dissociated from the rest, the apex is shown to be too much to the same side, and it therefore needs readjustment.

F.—Temporary Trials.

Before prescribing prisms or their combinations, it is well, when practicable, to let the patient wear a trial pair at home for a few evenings first, for sustained action alone affords a true indication of whether they will suit. Prisms and lenses can be bound in an ordinary trial-frame by a strip of gutta-percha, but as accidental rotation is very apt to occur, some other contrivance is desirable when prisms alone are in question. Fig. 20 represents a device I once suggested (I find since that Mr. Chas. Wray, F.R.C.S., of Croydon, has had a some-

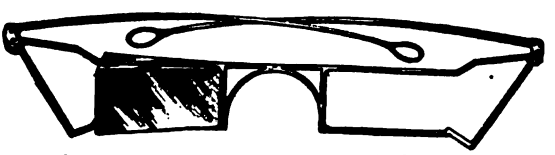

Fig. 20.—Rectangular Prisms in a Frame, as suggested in the text. This frame may be obtained from Messrs. Pickard and Curry.

what similar frame made with the addition of a spirit-level. Dr. Stevens says: "It is my custom to keep on hand a large number of spectacle-frames of uniform size, and a quantity of plain prism glasses of 1°, 2°, and 3°, which can be, without loss of time, slipped into the frames. With these I am able, in a few moments, to arrange temporary prisms for a patient."—"Archives of Oph.," June, 1888, p. 184) for the purpose of holding rectangular prisms, which I find can be made quite as cheaply as circular ones. The small size of the prisms, while yet allowing sufficient lateral range of movement for the eyeballs, would contribute to the manifest desideratum of lightness. No time is wasted in exact adjustment of the prisms, as their shape not only secures a correct position at once, but removes any possibility of subsequent displacement. Each prism has a longitudinal groove in its upper and lower surface, so that it need only be pushed in between the wires till caught by the elbow.

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So light a frame as this could be worn, together with an ordinary pair of spectacles, when it is desired to try for a few evenings the joint effect of prismatic and spherical glasses.

These prisms would also be exceedingly useful for those cases of paralytic strabismus in which partial or complete recovery may be expected, and for which prismatic spectacles are prescribed. The necessity, if this treatment of such cases is to be successful, of prescribing weaker prisms as the case improves (for without this they actually retard recovery), makes it desirable to have a set of test prisms, a pair of which can be worn for a few days or weeks, and be exchanged for another pair if they cause discomfort, or when they need to be weakened owing to progressive recovery.

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CHAPTER II.

DECENTRING OF LENSES; AND COMBINATIONS OF PRISMS WITH LENSES.

INSTEAD of combining a prism and a lens, where it is wished to obtain the effect of both, it is very frequently possible to get the same result by simply decentring the lens, a process which, though already well known, may be simply explained.

The "optical centre" of a lens is that point in it traversed by all rays which, after entering the lens, emerge from it in a direction parallel to their former course. (This one "property" is all that is necessary for our present purpose, hence it is mentioned, instead of giving a correct definition; see p. 289.) All rays which do not traverse the optical centre are bent from their former course to a degree which depends on the distance from this point, at which they pass through the lens—the greater the distance the greater the deflection. In other words, a lens, in every part other than the optical centre, has the effect of a prism upon any single ray of light—the effect of a weak prism near the optical centre, and of a stronger and yet stronger one with every further removal from it, and this equally with concave as with convex lenses. It is evident therefore, that by shifting a lens so as to bring a more peripheral part into use, a prismatic effect can be obtained just as much as if a prism had been cemented to the lens in its former unshifted position. Such displacement of the optical centre can be effected in one of two ways, the prismatic equivalent of which is identical, but each of which possesses an advantage of its own. First, the lens may simply be displaced as it is, rim and all, by lengthening or shortening the spectacle frame; or, secondly, the frame remaining unchanged, the lens can be decentred, in its rim as shown in Fig. 21. The dioptric strength, or refraction-correcting power, of this lens is exactly the same as that shown in Fig. 22, inasmuch as their surfaces have the same radius of curvature, but it is as though it were

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cut peripherally, as shown in Fig. 23, from a larger lens *c d*, so that its optical *O*, and geometrical *G*, centres do not coincide as in an ordinary lens. A brief study of Fig. 21, which gives the lens *a b*, of Fig. 23 in section, will show that the effect of cutting it eccentrically out of a larger lens is exactly the same as if a smaller lens of the same strength had been split to admit a prism between its two halves. Without altering its dioptric power, then, a prism has been virtually introduced. The geometrical centre of a lens is the point midway between all edges, as *G* in Figs. 21, 22, and 23. The optical centre, on the other hand, lies between all points (strictly, of course, points cannot be parallel, but only the tangents to the curve at the points. But the text will be easily understood)

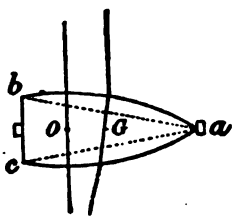

Fig. 21.

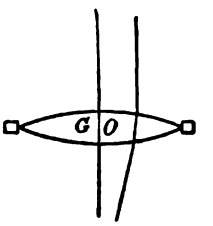

Fig. 22.

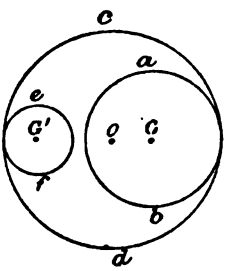

Fig. 23.

Fig. 21.—A Decentred Lens.
Fig. 22.—A Lens Normally Centred.
Fig. 23.—Peripheric Lenses Cut Out of a Larger One.

on the two opposite surfaces of a lens which are parallel to each other and which therefore have no more prismatic or deviating effect on a ray of light entering by one and emerging by the other than a plate of glass would have. It is needless to say that it lies in the thickest part of a convex lens and the thinnest part of a concave one. (It lies in the principal axis of a lens—the line joining the two centres of curvature; and divides the line of centres in the ratio of the radii of curvature.) For determining its position in any particular lens, an apparatus will be described further on. A lens is said to be normally centred when the optical and geometrical centres coincide as in Fig. 22; but to be decentred when, as in Fig. 21, the optical centre *O*, and the geometrical centre *G*, are apart, the amount of decentration depending on their distance apart. The two points may be so far removed from each other that

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the optical centre may come to lie outside the lens altogether. Such would evidently be the case with the small lens *e f* in Fig. 23, since the optical centre is at *O*. Fig. 24 shows this small lens in section, and it is evident at a glance that opposite surfaces are nowhere parallel, and that one or both of the surfaces would need to be prolonged considerably before any point could be found in the one parallel to a point in the other; were this done a line uniting the points would pass through the optical centre *O*. We have seen that the effect of decentring a biconvex lens is equivalent to splitting it into two halves, and inserting a prism between them (*b a c* in Fig. 21).

FIG. 24.—A Lens with its Optical Centre, *O*, far Outside Itself.

The strength of this virtually interpolated prism depends on, first, the amount of decentration, and, second, the dioptric strength of the lens. A strong lens needs decentring to a less extent than a weak one to produce the same effect. Table III. not only illustrates this, but enables us to find the exact prismatic effect of decentring any lens. All that is required is to fix on the number of millimetres (in the highest horizontal row of figures) by which a lens is known to be decentred, and the prismatic effect is found in the column beneath, opposite the dioptric strength of the lens. Conversely, should it be required to know how much to decentre a given lens in order to combine with it the effect of a certain prism, the eye runs along the horizontal line of angles opposite the known strength of lens till that angle is found nearest to the strength of prism required, when the number of millimetres at the head of the column will indicate the decentring necessary.

The word "decentring" is generally applied to the removal of the optical centre away from the geometrical centre of the lens, but we have already said that the prismatic effect is the same if the whole lens, rim and all, be simply displaced, as by lengthening or shortening the spectacle-frame; in other words, it makes no prismatic difference, so long as the optical centre is moved, whether the geometrical one remains *in statu quo*, or whether it is shifted equally itself. How are we then to decide between these rival modes, in any given case? De-

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TABLE III.

	1 mm.	2 mm.	3 mm.	4 mm.	5 mm.	6 mm.	7 mm.	8 mm.	9 mm.	10 mm.	11 mm.	12 mm.	13 mm.	14 mm.	15 mm.	16 mm.	18 mm.	20 mm.	22 mm.	24 mm.	26 mm.	28 mm.	30 mm.	32 mm.
·5D	1′ 43″	3′ 26″	5′	7′	8′ 25″	10′	11′	14′	15′28″	17′	19′	20′37″	22′37″	24′	26′	27′30″	31′	35′	39′	41′	45′	49′	52′	55′
·75D	2′ 30″	5′	8′	10′	13′	15′28″	18′	20′37″	23′	26′	28′	31′	33′	36′	38′	41′	46′	52′	57′	1° 2′	1° 6′	1° 12′	1° 17′	1° 22′
1D	3′ 26″	7′	10′	14′	17′	20′37″	24′	27′30″	31′	35′	38′	41′	45′	49′	52′	55′	1° 2′	1° 9′	1° 16′	1° 23′	1° 29′	1° 36′	1° 43′	1° 50′
1·5D	5′	10′	15′28″	20′37″	26′	31′	36′	41′	46′	52′	57′	1° 2′	1° 8′	1° 12′	1° 17′	1° 22′	1° 32′	1° 43′	1° 53′	2° 3′	2° 13′	2° 24′	2° 34′	2° 44′
2D	7′	14′	20′37″	27′30″	35′	41′	48′	55′	1° 2′	1° 9′	1° 16′	1° 23′	1° 29′	1° 36′	1° 43′	1° 50′	2° 4′	2° 18′	2° 32′	2° 46′	2° 55′	3° 12′	3° 26′	3° 40′
3D	10′	15′28″	31′	41′	52′	1° 2′	1° 13′	1° 23′	1° 32′	1° 43′	1° 53′	2° 3′	2° 13′	2° 24′	2° 34′	2° 44′	3° 6′	3° 26′	3° 46′	4° 7′	4° 27′	4° 48′	5° 9′	5° 29′
4D	14′	27′30″	41′	55′	1° 10′	1° 23′	1° 36′	1° 50′	2° 4′	2° 18′	2° 32′	2° 46′	2° 58′	3° 12′	3° 26′	3° 40′	4° 8′	4° 35′	5° 2′	5° 29′	5° 56′	6° 24′	6° 50′	7° 18′
5D	17′	35′	52′	1° 9′	1° 26′	1° 43′	2°	2° 18′	2° 35′	2° 52′	3° 9′	3° 26′	3° 43′	4° 1′	4° 17′	4° 35′	5° 9′	5° 44′	6° 17′	6° 51′	7° 24′	7° 58′	8° 32′	9° 6′
6D	20′37″	41′	1° 2′	1° 23′	1° 43′	2° 4′	2° 24′	2° 45′	3° 5′	3° 26′	3° 46′	4° 7′	4° 27′	4° 48′	5° 9′	5° 29′	6° 10′	6° 51′	7° 31′	8° 12′	8° 52′	9° 32′	10° 13′	10° 53′
7D	24′	48′	1° 12′	1° 36′	2°	2° 24′	2° 48′	3° 12′	3° 37′	4° 1′	4° 24′	4° 48′	5° 12′	5° 36′	6°	6° 24′	7° 11′	7° 58′	8° 45′	9° 32′	10° 19′	11° 5′	11° 52′	12° 38′
8D	28′	56′	1° 22′	1° 50′	2° 18′	2° 46′	3° 13′	3° 40′	4° 8′	4° 35′	5° 2′	5° 29′	5° 56′	6° 21′	6° 50′	7° 18′	8° 12′	9° 6′	9° 59′	10° 52′	11° 45′	12° 38′	13° 30′	14° 23′
9D	31′	1° 2′	1° 32′	2° 4′	2° 35′	3° 6′	3° 37′	4° 8′	4° 39′	5° 9′	5° 39′	6° 10′	6° 40′	7° 11′	7° 41′	8° 12′	9° 13′	10° 13′	11° 13′	12° 11′	13° 10′	14° 9′	15° 7′	16° 4′
10D	35′	1° 9′	1° 43′	2° 18′	2° 52′	3° 26′	4° 1′	4° 35′	5° 9′	5° 44′	6° 17′	6° 51′	7° 24′	7° 58′	8° 32′	9° 6′	10° 13′	11° 19′	12° 25′	13° 30′	14° 34′	15° 39′	16° 42′	17° 45′
12D	41′	1° 23′	2° 4′	2° 45′	3° 26′	4° 7′	4° 48′	5° 29′	6° 10′	6° 51′	7° 31′	8° 12′	8° 52′	9° 32′	10° 13′	10° 53′	12° 11′	13° 30′	14° 47′	16° 4′	17° 20′	18° 34′	19° 48′	21°
14D	48′	1° 36′	2° 24′	3° 12′	4° 1′	4° 48′	5° 36′	6° 24′	7° 11′	7° 58′	8° 45′	9° 32′	10° 19′	11° 5′	11° 52′	12° 38′	14° 9′	15° 39′	17° 7′	18° 34′	20°	21° 24′	22° 47′	24° 8′
16D	56′	1° 50′	2° 46′	3° 40′	4° 35′	5° 29′	6° 23′	7° 19′	8° 12′	9° 6′	9° 59′	10° 52′	11° 45′	12° 38′	13° 30′	14° 22′	16° 4′	17° 45′	19° 24′	21°	22° 7′	24° 8′	25° 38′	27° 7′
18D	1° 2′	2° 4′	3° 6′	4° 8′	5° 9′	6° 10′	7° 11′	8° 12′	9° 12′	10° 12′	11° 12′	12° 11′	13° 10′	14° 9′	15° 7′	16° 4′	17° 57′	19° 48′	21° 36′	23° 22′	25° 5′	26° 45′	25° 23′	29° 57′
20D	1° 9′	2° 18′	3° 26′	4° 35′	5° 44′	6° 51′	7° 58′	9° 6′	10° 13′	11° 19′	12° 25′	13° 30′	14° 34′	15° 39′	16° 42′	17° 45′	19° 48′	21° 45′	23° 45′	25° 39′	27° 29′	29° 15′	30° 58′	32° 37′

TABLE III. – Showing the prismatic effect of decentring any lens. *Procedure.*—Find the dioptric strength of the lens in the left-hand column, the prismatic effect is then found opposite, under the number of mm. of decentring. [This table is adapted from a thesis in 1884, where it appeared under another title ("Journal of Anat. and Phys.," Vol. XXI., p. 32). It was made from the simple formula: Tan $x = \frac{d}{f}$; x, being the deviating angle of the virtual prism; d, the decentring in millimetres; f, the focal length of the lens in millimetres.]

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centring of any kind has the disadvantage of being attended with proportionate increase of weight, as much as if a prism were inserted: the lens of Fig. 21 is very evidently heavier than that of Fig. 22. This fault is entirely avoided by the alternative of displacing the entire lens (instead of only decentring the optical centre in the lens), but, on the other hand, such displacing entails, beyond certain limits, a limitation of the field of binocular fixation. It may therefore be laid down as a practical rule that the dislocation of the optical centre should be effected by displacing the whole lens, rim and all, as much as can be done without interfering with the field of binocular fixation (*i.e.*, the range of lateral binocular vision), leaving only the remainder (should any more be required) to be obtained by decentration proper, that is by decentring the lens in its rim.

To take an example, let us suppose it is desired to prescribe spectacles such that each optical centre is 10 mm. nearer to the middle line than the centre of the eye, and we have found by the localizer that the centre of each eye is 32 mm. from the median (sagittal) plane. The effect of limitation of the field of binocular fixation must be considered for each case, for its inconvenience or otherwise depends on the distance of the patient's occupation; but say that, on consideration, 5 mm. of displacing for each lens is all that is advisable; that will make each geometrical centre 27 mm. from the middle line, and leave 5 mm. for decentring.

In prescribing the spectacles, therefore, some such form as the following would be used. To make such a pair of lenses

	R.	L.
Spherical.....	+ 4 D	+ 4 D
Cylindrical.....		
Geometrical centre.. ...	27 mm.	27 mm.
Decentration.....5 mm. inward.		5 mm. inward.

the optician might first make two larger lenses of + 4 dioptres, and 10 mm. (*i.e.*, twice the decentration) wider than the lenses required, which would then be cut out peripherically as in Fig. 23. But this would involve a serious waste of time and labor, since precisely the same result may be attained by the simpler plan of finding from Table III. the prismatic equivalent of the decentring, and then proceeding as he is accustomed to do when ordered to combine a prism of that deviat-

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ing power with a lens. He would cut the prism required, and then impart to its surfaces the required sphericity. Lest any confusion should arise here between the deviating and refracting angles, it will be well to repeat that the angle of refraction by which the two surfaces of a prism are separated, and by which the workman first cuts a prism, is twice the angle of deviation which is given in the table, and marked on the prismeters. In the example we have taken, in which lenses of + 4 D are decentred 5 mm., a reference to Table III. shows that the prismatic equivalent is 1° 10′, but this being the deviating angle must be doubled to get the angle of refraction, which will therefore be 2° 20′. Two prisms, each with their plane surfaces at an angle of 2° 20′, will now be made, and a sphericity of + 4 D be given to each surface. Having thus shaped the decentred lenses, the workman would next place them in a frame made with the centre of each rim 27 mm. from the middle of the bridge. The effect of such a pair of spectacles on a patient with the centre of each pupil 32 mm. distant from the middle line, would be the same as if normal lenses of + 4 dioptres, each combined with a prism of 2° 18′d, were placed exactly in front of the two eyes, as may be easily seen from the table; for 5 mm. of decentring + 5 mm. (*i.e.*, 32—27) of displacing give a total of 10 mm. for the alteration in position of the optical centre. Under the heading of 10 mm. in the table, opposite 4 D, is found the combined prismatic effect, viz., 2° 18′. With this, of course, the optician has nothing to do.

Though it was thought well in passing to give an instance of how a decentred lens may be prescribed, a better plan will be to mention, not the decentring, but the prism equivalent to it. This will save the optician all calculation, with the attendant possibility of a mistake.

It will be a simple proceeding for the surgeon, after finding the total prismatic effect it is desirable to produce, to deduct from it the proportion to be attained by displacing, and set down the rest in the form of a prism whose surfaces are to receive the needed sphericity. To take a varied illustration, we will suppose the lenses to be sphero-cylindrical. If the axis be vertical, the effect of a cylinder on convergence is precisely the same as that of a spherical lens of the same curvature, but with each departure from the vertical it acts like a

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weaker spherical lens till with axis horizontal its effect is *nil.* A lens, therefore, of + 3 D sph., + 2 D cyl., axis vertical, would affect convergence like a + 5 D sph.: with axis horizontal it would affect convergence like a + 3 D sph. Let us take for an example such lenses of + 3 D sph. and + 2 D cyl., axis vertical, the total effect on convergence being that of a spherical lens of + 5 D. Suppose it is wished to relieve the convergence of each eye by 2° for an occupation distance of 15 inches. It is decided, let us suppose, that 7 mm. of displacing can be allowed without interfering with the required field of fixation. But 2 mm. out of these 7 mm. must be deducted as useless for the purpose, since they only go to counteract the excess of convergence, which lenses placed precisely in front of the centres of the eyes would occasion in near vision, for it is clear that the lines of fixation would then traverse the lenses internal to their optical centres. With habitual vision for 15 inches, we have to allow 2 mm. for this reason, and with vision for 10 inches we have to allow 3 mm., since only if the lenses were 2 mm. or 3 mm. respectively, internal to the centre of the eyes, would they have no effect on convergence, for then only the visual axes would traverse the optical centres. This position therefore forms the zero, by departing from which in either direction the convergence is affected. To return to our example, after deducting these 2 mm., 5 mm. of effective displacing remain. By Table III. we find the prismatic equivalent of 5 mm. of displacing to be exactly 2°. This is all we desired, and there is therefore no need for decentring. Had it been desired to afford greater relief to convergence, say 4°, then the remaining 2° should be prescribed as prismatic combination. If the centre of each eye be 32 mm. from the middle line, then this, less the total 7 mm. of displacing, would make the geometrical centre 25 mm. from the middle of the bridge, and it would stand thus:

	R.	L.
Spherical	+ 3 D	+ 3 D
Cylindrical	+ 2 D axis vert.	+ 2 D axis vert.
Geometrical centre	25 mm.	25 mm.
Prismatic	4° (2°d) edge out.	4° (2°d) edge out.

The optician should understand that the new marking is intended whenever the letter "d" is appended. In this case,

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therefore, he would cut two prisms, each with an angle of refraction of 4°, and impart to one surface a sphericity of + 3 D, and to the other a cylindricity of + 2 D, setting them in a frame with the centre of each rim 25 mm. from the middle of the bridge.

To relieve convergence, prisms should be "edge out;" while convex lenses should be displaced inward, and concave lenses outward.

To meet excessive convergence, prisms should be "edge in;" convex lenses displaced outward (only slightly practicable, owing to limitation of near binocular fixation) and concave lenses inward. It is with strong lenses, such as those for aphakia and high myopia, that care in the position of the lenses is of chief importance.

"Orthoscopic spectacles," as described by Dr. Scheffler, have been so long known that they must not altogether escape mention. In these, accommodation and convergence are affected in equal amount. The two lenses have but one optical centre common to both, just as though they were cut from opposite edges of one large lens. The proof of their correct manufacture is that they throw a single distinct image of a flame upon a wall. They have generally been prescribed in a few standard strengths, but they can be made for any patient by combining with each of his lenses a prism whose deviating angle is found in Table III., opposite the description of lens and under the number of millimetres by which the optical centre of each eye is distant from the middle line. These spectacles undoubtedly may have their place, but it is better to ascertain the conditions of convergence in each case and prescribe accordingly, rather than to adhere to any fixed combinations.

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CHAPTER III.

LOCALIZATION.

Localizing the Eyes.

It will be at once evident from the preceding section, that it is impossible to prescribe spectacles of any kind with a view to produce a definite prismatic effect without first knowing the precise distance of the centre of each eye from the middle line, and in clinical work the need must have been often felt for a quick yet reliable objective test. Many subjective tests are in existence already for the purpose of telling, not the distance of each from the middle line, but the mutual distance between the centres of the two eyes ("interocular" or "intercentral" distance); such as Smee's "visuometer" as used by Donders, Landolt's chiasmometer, Snellen's frame, or Dr. Johnstone's trial-frame with the short tubes in the two discs. But an objective test is more desirable, and especially one for each eye, and though it is true that single points have already been placed before each pupil, such as, for example, the intersection of cross-wires, with a view to obtain this information, yet the very principle of such a single "sight" or "bearing" is fallacious. It affords no guide or guarantee for the position of the observing eye, which is therefore left to guess-work. For a test to be true in principle, not only must the visual lines of the observing and observed eye coincide, but the line so composed must be exactly at right angles to the line uniting the centres of the two eyes, or at least if one eye be examined with any angle of inclination, the inclination must be the same in the examination of the other (on the principle of the parallelogram). It need hardly be said that this cannot be insured when only a single point is used for a bearing. To overcome this difficulty the writer has had a little device made (Fig. 25), with two sights so disposed as to always be in a line at right angles to any trial-frame in which it is placed. One pupil is localized at a time, all that is necessary being to in-

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crease or diminish the breadth of the frame till the two sights and the centre of the pupil are in line as in Fig. 26; the patient meanwhile is bidden to be looking at the pupil of the surgeon's observing eye, by doing which the two visual lines (*i.e.*, that of the observing and that of the observed eye) come to practically coincide. If the patient is a child it is quite easy to

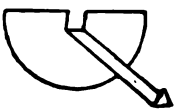

FIG. 25.

excite its interest in its own miniature reflection in the surgeon's pupil while taking the observation, adeptness in which needs a few trials to become familiar with the parallactic motion. The instrument is then placed in the other rim of the frame, and the observation repeated for the other eye.

By this method we comply with the two afore-named conditions of accuracy; the visual lines of the observing and observed eyes coincide, and of necessity they are both at right angles to the trial-frame. The frame must of course be one movable by a screw, and marked in millimetres, so that the record can be read off after localizing each pupil. The dis-

FIG. 26.

tance of the centre of each eye from the middle line is in each case half what is registered by the frame. It is true that the present methods are considered sufficiently exact for practical purposes, but there is, nevertheless, a pleasure in working on correct principles, and a number of small inaccuracies in the different steps of testing and prescribing may amount together to a considerable error. The frequent and careful use of this

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principle will show how many an unsuspected difference exist in the position of the two eyes, and will train the surgeon wh uses it to a quicker appreciation of a symmetry and its amoun When ordinary spectacles are prescribed for eyes placed un symmetrically, the prismatic effect is greater for one than th other, which may (or may not) be deleterious, or even adva tageous, according to the nature of each case, which, therefor needs individual investigation.

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CHAPTER IV.

ANALYSIS OF SPECTACLES.

So far we have dealt with the synthetical part of our subject, how to combine lenses and (virtual) prisms. The analytical part must now be considered. When a patient comes to us with a pair of spectacles already in use, but which cause discomfort, how are we to analyze their prismatic effect and find how the glasses are centred? One thing is clear, that we must set ourselves to discover with all possible accuracy the cause of the discomfort. It may be due to the irritability of the patient's nervous apparatus, but before deciding this we must exclude the other alternative, that the spectacles are not the best in every way that could be given. The focal length of the lenses is easily determined by the plans given on page 273. The next thing is to measure the distance between their optical centres, or, preferably, the distance of each from the centre of the bridge, and this may be done in several ways. If sunlight is procurable the spectacles may be held at their focal distance from a card exactly parallel to the two lenses; then the distance between corresponding points of the two spots of light on the card gives the required distance between the optical centres. If artificial light be used, the distance between the spots of light (more strictly, between corresponding points in them) must be multiplied by the distance of the light from the spectacles and divided by that of the light from the card. In this experiment care must be taken that the light and the bridge of the spectacles are in a line perpendicular to the lenses and the card. A modification of the phakometer could easily be adapted for this purpose. But inconvenience attaches to the use of either direct sunlight or artificial light, and if they can be dispensed with the better. Fig. 27 illustrates a rough mode of telling the distance between the optical centres. The spectacles are held horizontally, and some inches above a card marked to one side with a

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vertical line x, and toward the other side with parallel lines y, at different measured distances from the single one. The observer, holding his left eye about a foot above, and as nearly vertically over the left lens as he can judge, closes the right eye, and moves the spectacle-frame from side to side till the line x appears unbroken by the left lens. Now, without moving the head, the right eye is opened and the left closed, and that line which appears to be least displaced by the right lens is the line nearest its optical centre, and the number above it furnishes a rough estimate of the required distance between the two optical centres. To ascertain whether each optical centre is midway between the upper and lower border of its

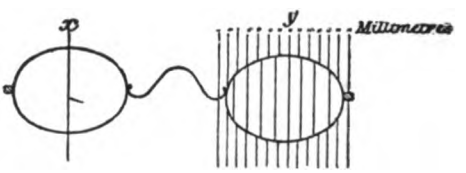

Fig. 27.—A Simple Way of Telling the Distance between Optical Centres of a Pair of Spectacles.

rim, each lens must be held lengthwise over the left-hand line till it appears to run continuously. The principle (though not new) of this test is so simple, yet its imperfections so many (besides its want of accuracy, it only gives the mutual distance between the optical centres, and not the distance of each from the middle of the bridge, and it is not available when the optical centre lies outside the lens), that I have constructed an "analyzer" to secure the former without the latter; it is shown in Fig. 28. The two essential conditions are that the lenses should be parallel to the card and that the line of vision in looking through each lens should be exactly vertical. The first is secured by laying the spectacles on the plate of glass $c\,d$, which is movable from side to side; and the second by keeping the eye so that the line x is maintained in apparent coincidence with the line $n\ p$. The letters $a\ b$ indicate the narrower strip, also movable, marked exactly across the middle with a transverse line x. On either side of the slides is a millimetre scale with the zero in the centre. The broad slide has a long line w right across it, opposite the zero of its scale. The card $r\ s$ has only one line upon it, exactly beneath the central lines of the glass strips, and it can be placed either in

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ttom of the apparatus, as in the figure, or in the grooves
r up, for lenses whose focal length is shorter than the
t of the glass plates above the lowest grooves. The card
erally used in its lowest position, because distance of the
pon it from the lenses, as we have already seen with
s, magnifies the phenomenon and makes the experiment
delicate. The height of the upper surface of the glass
from the card in the lowest grooves is about four and
lf inches.

analyze a pair of spectacles. lay the centre of the bridge

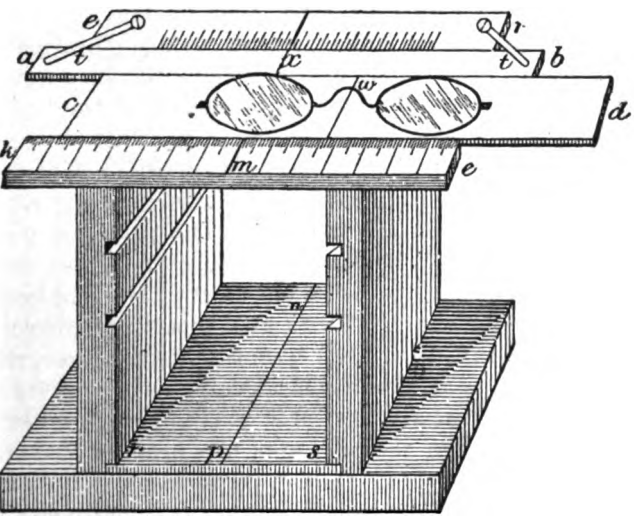

Fig. 28.—The First Form of Analyzer.

e line *w*, and place the observing eye so that the lines *x*
p appear to coincide. Now move the broad slide bear-
e spectacles till the line *n p* appears undeviating through
ens; then *w* points to the distance between the optical
e of that lens and the centre of the bridge. Repeat in
me way for the other lens.

e geometrical measurements, as for the breadth of frame
he rims, are made by laying the spectacles still length-
but half on the broad slide and half on the narrow. By
ng the line *x* at zero, and placing any required point of
pectacles over it, then drawing out the line *w* to the
point, the latter line indicates the required distance, on

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the scale *k e*. It is well to have the narrow strip fixed by strong pieces of watch-spring *t t*, like those for microscope slides, or by a little screw at one corner of the frame.

Lastly, by laying the geometrical centre of a lens opposite the zero of the scale *k e*, the line *n p* will, if it be a decentred lens, appear displaced through it. How great is the apparent displacement? By answering this we tell the prismatic equivalent of the decentring without recourse to any table. We must use another sight (another way is to use a plane mirror instead of the card *r s* and keep the line *x* in line with its reflection—a little difficult sometimes) fixed to the narrow slide perpendicularly beneath its line *x*, then by holding the eye so as to keep them both in apparent coincidence (thus insuring a vertical line of vision) and moving them till they appear exactly abreast of the apparent displacement of the line *n p* as seen through the lens, the prismatic equivalent of the decentring is indicated by the degree on the scale *e f* to which *x* points. The special applicability of this mode is when the optical centre lies outside the lens. The principle would, of course, be the same if, instead of moving the glass slide, the analyzer were so made as to let the card at the foot be moved alongside a metric scale. When the lenses under test are of shorter focal distance than the height of the analyzer, the card must be placed in one of the other two pairs of grooves: then, though the use of the scale *k e* is unchanged, it must be remembered that when the card is in the grooves half-way up, each figure in the scale *e f* must be multiplied by two, and when the card is in the highest grooves, as for cataract lenses, each must be multiplied by four. (For the guidance of opticians, it may be said that the scale *e f* can be marked either in millimetres or in degrees; if the latter, then the height of the lenses above the card must be 53.3 mm. or some multiple of that number, for the degrees to be one millimetre from each other, or some multiple of a millimetre. But if marked in millimetres the height of the lenses above the card should be 100 mm., so that by a table of tangents affixed to the analyzer the degree can be found. This is the most exact method, especially for strongly prismatic lenses, but being rather less simple is not mentioned in the text.)

Another Form of Analyzer.—The instrument already described is, perhaps, most appropriate for surgeons, since no

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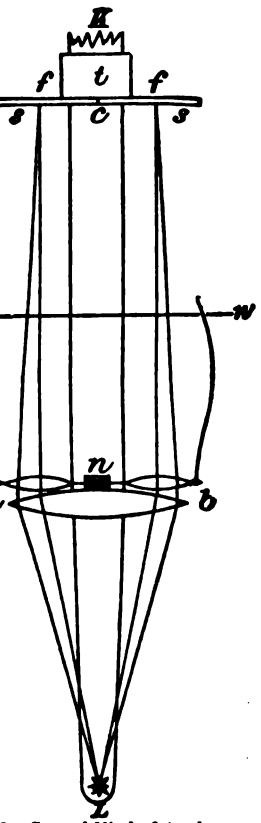
cial light is needed, and it is small and portable. For ians, however, who use large numbers of spectacles and to classify them, another kind is recommended, which its both the focal length and the position of the optical es to be tested at one and the same time.

plan of it is shown in Fig. 29. Upon a horizontal strip



9.—Second Kind of Analyzer.

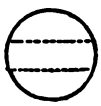


Fig. 30.—A Lens with the Equatorial Zone marked by Dotted Lines.

Fig. 31.—Plano-convex Lens.

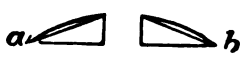


Fig. 32.—An Analyzer made with a Trial-frame.

ood *k l* is fixed an equatorial portion of a large lens (pref- y plano-convex, as in Fig. 31, to lessen spherical aberra- . Fig. 30 represents in miniature how this rectangular is cut from the equatorial band or zone of the large lens: ould be as long as the broadest spectacles used. At its distance is placed a flame *L*, so that parallel rays of are thrown upon a screen *s s*, which is fixed to the trav-

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eller *t*, and is provided with a metric scale, running right and left from the central zero at *c*. A small wooden nose *n* is provided to support the bridge of the spectacles, and two wires *w w*, fixed to the under surface of the strip of wood, so as not to interfere with the movements of the traveller, support its limbs or temple-pieces. Two movable stenopæic slits (in default of which the large lens should be blackened except in two vertical stripes) greatly increase the definition of the focal points *f f*, which indicate upon the metric scale the distance of each optical centre from the middle of the bridge. After laying a pair of spectacles in position, the traveller is moved till distinct images are thrown on the screen; then the dioptric strength or focal length is read off from the flat strip which is marked both in dioptres and inches, and the position of the optical centres is read off from the screen. Fig. 32 is to show how a temporary style of the instrument can be made by placing in each side of a common adjustable trial-frame a lens in conjunction with a prism. (The lenses chosen should have a focal length equal to the most convenient distance of the flame; then, by Table II., prisms should be selected nearest to the strength indicated opposite the dioptric description of the lens in or near the columns headed by 28 mm. or 30 mm. After setting them in position with the apices of the prisms exactly outward, the final correction is made by adding to each couple a vertical stenopæic slit, and holding the whole combination exactly athwart direct sunlight, so as to throw two fine images upon a card held at the focal distance of the lenses. The trial-frame is then adjusted so that the two images exactly coincide. Their action now is the same as that of the large lens.) But rectangular reading-glasses can often be obtained in shops, and the portions not to be used can be covered with asphalt or with black silk plaster.

The Effect on Convergence of Displaced or Decentred Lenses.

This study will cause embarrassment if allowed in any way to be confused with those of previous pages, and perhaps, for that reason, the less said on it the better. It must be clearly borne in mind that the prismatic equivalent of decentring a lens and the effect of that decentred lens on convergence are

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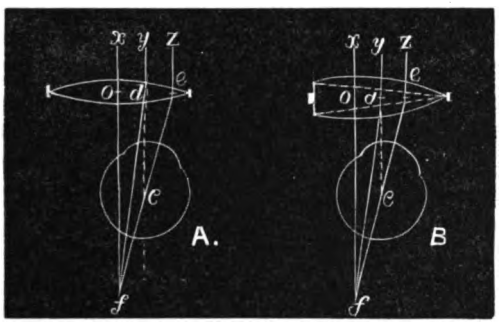
distinct things, though at first sight they appear the
e. Suppose we decentre a lens, or what is the same thing,
ose we place a normally centred lens precisely before one
and associate a prism with it. We might anticipate that
angle of deviation of this prism would exactly express the
t on convergence. But it is not so. Fig. 33, B, represents
centred lens, the action of which is precisely similar to a
m and lens, for, as said before, it is as if the lens were split
vo, and the prism shown in dotted outline were inserted



. 33.—A. The right eye is looking at a distant object through a lens displaced , rim and all, by a distance *o d*; *d c e* is the effect on convergence. B is the same oking through a lens of the same focal length, but decentred in its rim by the listance *o d*. The dotted lines indicate the prism that would be equivalent to the ring, and the effect on convergence is the same as with A.

een the two halves. Now, it will be evident at a glance
the angle *c d f* is the deviating angle of the virtual prism,
e the greater angle, *d c e*, is that which represents the
t on convergence. It makes no difference to the effect on
ergence whether a lens is decentred or displaced to the
e amount as in Fig. A.

here is one exception to the discrepancy between the
natic equivalent and the effect on convergence, and that
hen the lenses are convex and the object of fixation is at
focal length. Within that distance the effect on con-
ence is less, and beyond it more, than the prismatic equiv-
. But with concave lenses it is always less.

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CHAPTER V.

A BRIEF OUTLINE OF THE CHIEF CLINICAL APPLICATIONS OF PRISMS.

THERE are seven uses of prisms in the consulting-room which may be described first; then five more uses as worn by patients will follow, making in all twelve clinical applications. (In working with prisms, we are happily not concerned with the angle alpha, either in testing or prescribing.) Prisms are—

A.—OF SERVICE IN THE CONSULTING-ROOM.

1. To measure the absolute minimum of convergence (r^c). This is generally a negative quantity, and then the minimum of convergence of the visual axes is identical with their maximum of divergence. Its measure is therefore taken by finding the strongest pair of prisms, with their edge outward, compatible with single vision of some distant object, as shown in Fig. 34. The deviating angle of each prism expresses the

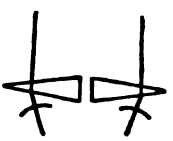

FIG. 34.—The Absolute Minimum of Convergence.

"absolute minimum of convergence" for each eye. The figure also makes clear that the visual axes meet behind the head during the experiment, and their point of intersection is still called "the far point of convergence," though its position is negative instead of positive. If a single prism be used, since its effect is distributed between the two eyes, its angle of deviation must be mentally halved for each. Remoteness of the point of fixation during the experiment is an important consideration if it is desired to reach the absolute minimum, for the knowledge of the object being at a great distance favors

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evolution of diverging energy, and in normal eyes the
pathy of convergence with the very beginnings of accom-
lation (even, for instance, for six metres) is very great
nvestigations," etc., Maddox, "Jour. Anat. and Phys.," Vol.
., p. 574). If lenses are worn in the trial-frame, for ame-
pia, of sufficient strength, the experiment can be made by
arating them if concave, or approximating them if convex,
double vision occurs, and then the prismatic effect can be
culated from Table III.

Thus if the distance between the optical centres of lenses
– 4 D be increased till it is 16 mm. greater than the dis-
ce between the centres of motion of the eyes, we divide the
nm. between the two eyes, for clearly each lens is displaced
m., and therefore by the table there is 1° 50′ of divergence
each eye, or just one metre angle. It is expressed by say-
that the absolute minimum of convergence is — 1° 50′. Dr.

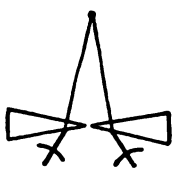

Fig. 35.—The Absolute Maximum of Convergence

rens finds that with vision for six metres the normal power
he abducting muscles is measured by a prism of 8°, or, pos-
y, 9°. He first corrects any existing ametropia, but does
appear to calculate for the prismatic effect of the lenses
ing the experiment ("Archives of Oph.," June, 1888, p.
). Schweigger also gives 8° as the average strength of
m in *E.*, and quotes Schuurman as giving 5.6° as the aver-
prism in *H.* and 11.6° in *M.* In making this test with M,
action should first be corrected, and the effect of the lenses
he direction of the visual lines calculated for by Table III.
H. the test should be made both with and without lenses.

2. To measure the absolute maximum of convergence (p^c).
d the strongest adducting prisms, as in Fig. 35, compati-
with single vision of a test type or printed page held as
e to the eyes as accommodation will permit.

This test, though described for completeness, is not easily
ugh made with ordinary prisms to be much used, or to re-
e in practice the old-established custom of advancing a

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finger toward the root of the nose till one eye deviates outward, or the use of Dr. Landolt's dynamometer, in which the finger is replaced by a line of light. The two last tests, however, it may be suggested, do not give the "absolute maximum of convergence," for as soon as the point of fixation passes within the binocular near point of accommodation, diffusion circles appear on the retinæ, and increase rapidly in size with every approach till the eyes resign the impossible task of accommodation—then the ciliary muscle relaxes, and with it the convergence.

Just as in absolute hypermetropia, efforts of accommodation cease as soon as the impossibility of obtaining sufficient definition is realized. These tests discover only, I believe, the point of the resignation of ciliary effort. Even were the accommodative efforts to persist, it is scarcely to be expected that two pictures on their respective retinæ, each composed of a mass of diffusion circles, should excite the desire for fusion in its full strength, as clearly defined pictures would. At first sight the highest adducting prisms compatible with single vision of a test type held at the absolute near point of accommodation would seem to give the true "absolute maximum" of convergence; but here there is a new difficulty, for the chromatic dispersion of the prisms spoils the definition of the pictures on the retinæ, though truly it might be avoided by using a monochromatic light. (Such light may be obtained of a pure yellow by placing common salt, or of a pure red by placing some salt of strontium, upon the wick of a spirit-lamp of which the flame is kept steady by incombustible gauze.) By adding the result of this test to the already ascertained "negative convergence," we get the "absolute range (amplitude) of convergence" (a^c), of which, according to Dr. Landolt, not more than one-third or one-fourth can be continuously in exercise for comfortable vision.

3. To measure the "relative range of convergence" (a_1^c). For this we find the strongest pair of abducting prisms, as shown in dotted outline in Fig. 36, and then the strongest pair of adducting prisms, as shown in continuous outline, compatible with single distinct vision of an object or type at some chosen distance. The distance most suitable is that at which the patient's daily work is done (occupation distance), and for which spectacles are most required.

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The abducting prisms measure the negative part of the range (r_i^c), and the adducting prisms its positive part (p_i^c). This test would probably be the most valuable of any, if the best ratio between the negative and positive parts were well worked out for different distances of vision; meanwhile it may be gathered in large part from Fig. 57 of Donders' "Anomalies, etc." At twelve inches, for instance, the subject of his experiments had a relative range of nearly seven metre angles, the negative and positive parts being equal. At eight inches the relative range is slightly greater, but its parts are still equal. At six inches the positive part exceeds the negative. For distances greater than twelve inches the chart is incomplete on

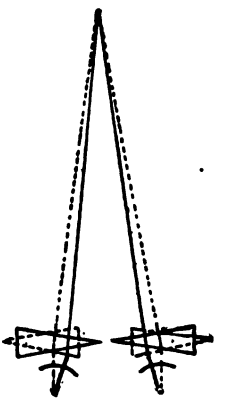

Fig. 36.—The Relative Range of Convergence.

the negative side, but the positive part is at 24 inches 3 full metre angles, and at 72 inches about 2½ metre angles.

Since the relations between convergence and accommodation become temporarily altered by prolonged efforts to overcome strong prisms, all observations should be taken as quickly as possible; hence the rectangular trial-frame of Fig. 20 would be better than an ordinary one, since no time is wasted in setting a prism.

The principle of "rotating prisms," as introduced in America some years ago, should be a valuable one (these prisms are cogged edge to edge so as to rotate, one before each eye, in opposite directions at equal rates); but as I have not yet tried them, more cannot be said now.

In testing the ranges of convergence it is undoubtedly best

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to use pairs instead of single prisms; then the deviating ang
of each gives the result for each eye. Should, however,
single prism be used, its deviating angle must be halved
each eye; and should the pair be an odd one—that is, with o
prism stronger than the other—half the sum of their deviati
angles must be taken for each eye. The prismatic relief fou
desirable to give by any of these plans would of course app
to each lens in the spectacle-frame.

4. To dissociate convergence and accommodation. T
is done by placing a weak prism with its edge upward
downward before one eye. One of 4° (2°d) is generally stro
enough to create vertical diplopia which cannot be overco
in distant vision; but for near vision a stronger prism m
be used. Graefe's was 15°.

In this way the stimulus to convergence is suppressed, a
the eyes take that position, relatively to each other, which
due to the central association (in the nerve centres) betwe
convergence and accommodation. Accommodation is in n
mal exercise and creates a definite proportion of associated
sympathetic convergence, which it is the purpose of the t
to estimate. To give a simple illustration, we may compa
the centres for convergence and accommodation to the t
legs of a tuning-fork; the slightest vibration in one provo
vibration in the other. It is a perfect instance of irradiati
which appears to be a necessary accompaniment of all nerve-
energy, but which is here economically gathered into a mut
channel between two confederate functions which are alwa
associated in daily work. If the two images in this test
pear in the same vertical line, the associated convergence
just equal to the accommodation; if they are not in the sa
vertical line, the diplopia is of course either homonymous
heteronymous. In the former case convergence is in excess
accommodation, and we say there is "relative convergence
and in the latter there is a deficit of convergence, and we s
there is "relative divergence." [By an easy paper experim
communicated to the Roy. Soc., Ed. (Pro. 1883–84, p. 4
for the author by Prof. Crum Brown, any one may convi
himself that with dissociated distant vision some converge
of the visual axes is generally, though not always, prese
This was called "the initial convergence." With accommo
tion for nearer distances, "associated or accommodative c

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ence" is added to it till the "point of coincidence," where
nmodation and convergence are abreast. For distances
er than this there is generally relative divergence, which,
gradually reaching its maximum, again declines to a
d point of coincidence near the near point of accommoda-
and speedily gives way toward the absolute near point to
ive convergence. These and kindred points will be found
ed out in the "Jour. of Anat. and Phys.," Vols. XX.
XXI., in papers already referred to. The results were
ned by the "visual camera;" and to obtain similar ones
essential to employ a method of the same kind which
note of the tiniest aberrations, and allows them full time
cur in a field entirely dark but for the two points of light.]

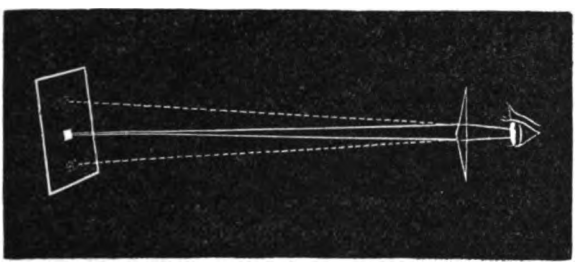

FIG. 37.—A Double Prism. From "Jour. Anat. and Phys.," Vol. XX., p. 496.

he point of fixation may be, according to Von Graefe's
estions, either a distant flame or a vertical line with a
situated upon it on a card. In the latter a fallacy has
shown, from the fact that the reduplicated line still
es a desire for single vision of those portions which over-
Noyes, "Treatise on Diseases of the Eye," New York,
p. 88). When a light is made the point of fixation, a
le prism, like that in Fig. 37, makes it much easier to de-
the condition present by observing whether the central
e, which is seen by the unclad eye, appears to the right
t of the imaginary line between the other two, which are
images seen through the prism. The degree of devia-
can be measured by finding the additional prism, edge in
ut, required to bring the images into a vertical line, as
ested by Graefe; or the first prism may be rotated till
images are vertical, and then from the strength of the

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prism and the degree of turning a calculation can be made of the deviation. (The sine of the angle through which the false image was displaced is the multiple of the sines of the angle through which the prism has been rotated, and the angle by which it deflects rays of light. Sin. x = sin. $\triangle$ sin. r.)

For near vision the double prism may also be used, as in the figure, or with a device marked on a card, which measures the deviation at the same time; but I have come to prefer a single prism, mounted with its edge upward on one end of a strip of wood along which a traveller bears the same device, which now appears only doubled as in Fig. 38 instead of trebled. It is of course desirable to make this test at the occupation distance of different patients, and if the scales are marked in degrees or metre angles a different one is necessary for each distance; if marked in mm. and provided with an indicator

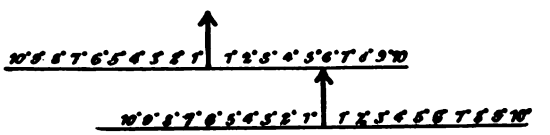

FIG. 38.—A Metric Device for a Single Prism. The lower row is marked on a card and the upper is its false image.

capable of being lengthened or shortened, one is sufficient, but a calculation is necessary.

What is the due significance to attach to this test? It clearly does not decide the strength of one rectus, for convergence is a single function affecting both eyes equally. It is true that each rectus is a link in the chain of convergence, and may be the weak link, but that would show itself best in testing the lateral movements of the eyes. Neither does it afford a pure test of the strength of convergence; for the converging innervation might respond in power to its proper stimulus and yet fall short of this test from its central communication with accommodation being abnormal or affected by disease. Neither does it entirely test the freedom of communication between the centres; for that might be perfect, and yet the test exhibit failure from some imperfect link in the chain of convergence. It really tests all in a joint way, so that its full value only comes out when it is made for both near and distant vision, and is conjoined with some of the previous tests to interpret the exact import of its revelations: the way in which

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vary slightly according to the time of day, the state of ympathetic system, and other conditions, has been de- d elsewhere ("Investigations," etc., J. A. P., Vol. XX.,).

To disclose any tendency to vertical diplopia (hyper-). Accommodation and convergence are dissociated for urpose by a prism with its edge outward, and slightly ger than can be overcome—say one of 6°d. In this test ally, precision in the setting of the prism is essential, imperfect setting can produce in a normal patient an ent difference in the height of the two images. This is in Fig. 13.

teresting cases of latent vertical diplopia, with very suc- l correction, have been recorded by many, especially in ica. In making the test, the object should be a flame distance of six metres, and the full prismatic correction l then be given.

stead of a single prism, a double prism with its axis hor- l, like that in Fig. 37, may be used, and it is not difficult e patient to tell whether the central of the three images -distant between the other two. Better still is a stronger e prism with each refracting angle of 10°: this is used ts axis vertical instead of horizontal, so that the three s appear in one horizontal line, and the patient is asked whether the central one is higher or lower than the etween the other two.

t a fourth, and perhaps easiest, way of making the test se an ordinary stereoscope ("Ophthalmic Review," "An act," etc., Dec., 1886, p. 348), marked before one eye with ical line graduated in degrees up and down from a cen- ero point, and before the other eye with a horizontal line y level with the zero point just mentioned. On looking he instrument, the horizontal line appears to lie across rtical one; if it crosses it at zero there is shown to be dency to vertical diplopia; but if otherwise, the latter is t, and its amount is expressed by the figure which the ntal line crosses, and which the patient is asked to read The stereoscope must be held horizontally and with care. l these are "diplopia tests," or "equilibrium tests," since lepend on the dissociation of the eyes by the artificial on of diplopia. But Stevens has shown the desirability

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in these cases of also finding the highest prism, edge up, compatible with single vision, and the highest prism, edge down ("Archives d'Ophthalmologie," XVI.; 6; p. 544).

6. Prisms have sometimes been used to measure strabismus, or to measure the degree of any existing diplopia, but for this they are useless.

Not so, however, when the purpose is to ascertain by what proportion diplopia must be lessened to place its entire correction just within the control of the innervation concerned in the preservation of single vision. It suffices to find the weakest prism, with its base-apex line parallel to the line between the two images, which enables single vision to be effected. The deviating angle of this prism informs us of the proportion of the diplopia which is beyond control, and when this proportion is deducted from the whole diplopia, the remainder is the proportion which can be brought under control. It is sometimes advisable to prescribe prisms just strong enough to bring the diplopia well under the control of "the fusion innervation" (as it is sometimes named), but no stronger, so as to exercise the neuro-motor mechanism till its strength is regained. Compare p. 287. For homonymous diplopia the edge of the prisms must be directed inward, and for heteronymous (crossed) diplopia outward, or, in simpler words, "place its apex in the same direction as that in which the eye deviates; thus if the eye turns outward, the apex of the prism must be turned outward; if the eye turns in, the apex must be inward also" (Juler).

7. To decide the presence of binocular vision. The fact that a prism before an eye deflects the line of fixation has been turned to account by Graefe, in cases of suspected malingering, to see whether an eye has such a thing as a line of fixation, or in other words whether it is a seeing eye.

The following is perhaps the fullest plan. After fixing the patient's attention, we may first place a strong prism, say of 30° (edge in or out), before the sound eye. If, while doing this, the other betray no associated movement, vision is almost certainly binocular, for nothing but fixation could preserve it from accompanying the deflection of its fellow, except in paralytic cases. Should it move, however, nothing is proved beyond the expected fact that its fixation power is less perfect than that of the other.

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The same prism is now similarly placed before the doubtful eye; if while doing so the other display an associated movement, vision is not only binocular, but the impugned eye is the better of the two, at least for the distance of vision employed at the time: but if there be no associated movement nothing is proved.

Lastly, on placing a prism of about 10° before the doubtful eye, and quickly withdrawing the prism, we closely watch the eye from which it is taken; for a corrective movement, if detected, at once tells us that its line of fixation has been deflected by the prism, and that it has therefore a line of fixation and is a seeing eye.

The subjective test, in which the patient's statements have to be relied on, is, for obvious reasons, often unsatisfactory, though it possesses the peculiar advantage of convincing a by-stander from the patient's own mouth, and of thus relieving the surgeon from the sole responsibility. It consists in placing a prism first before the unsound eye, and asking whether any object, preferably a flame, appears double. The reply is almost certainly negative. The prism is next placed before the sound eye, and the question repeated, "Do you now?" If incautious, the patient may admit that though he sees nothing with the bad eye, he sees double when the prism is held before the good one. A refinement has been introduced in America by first placing the edge of the prism partly over the pupil of the sound eye, to show the patient that vision may be double with that eye alone, when the other is covered by the hand. A stereoscope, however, with a circle on one side and a cross on the other, or Snellen's colored test types, afford better subjective tests than any with prisms.

B.—Prisms may be Worn in Spectacles.

1. To relieve any strain between convergence and accommodation (esophoria or exophoria). The existence and nature of the strain must, if possible, be first made out. An ideal investigation would include, after the usual study of accommodation: (1) The total range and region of convergence; (2) its relative range, with vision for occupation distance; (3) the effect of dissociating the two functions with both near and distant vision. But with present methods, to attempt all these

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makes too great a demand on time, except for a few cases order to form a groundwork for others; and in general, tho tests must be selected which are most suitable for the ca How, when refraction also needs correction, to apportion t desired relief between displacing on the one hand and dec tring or the addition of a prism on the other, has been sho in the previous section on "Decentring of Lenses." There little to be gained from prisms stronger than 2°d.

Dr. Noyes' plan is to "first decide the proper working d tance, and the correcting-glass which for this point is requir and with it ascertain the muscular error," by dissociation, e He adds: "To give prisms equal to one-half the amount error is usually sufficient," and says further: "We must so times order prisms for permanent wear, either with or wi out a refractive correction, and this is indicated when a m cular error has been detected in testing for the distance twenty feet. Here the correction of weakness of the exte or of vertical diplopia, is of the utmost importance, and t full correction must be prescribed. . . . It is sometimes traordinarily gratifying to see what relief is obtained by su ably-chosen glasses." What he terms "insufficiency of exte for distance and of interni for near vision" implies, he sa general muscular weakness, and indicates constitutional tre ment and Dr. Dyer's "invigorant plan." This consists giving the patient four squared prisms, of about 2½°, 5°, 1 and 15° respectively: twice a day for ten minutes he is to fi flame or door-knob at twenty feet, and exercise abduction a adduction (really relative divergence and convergence), beg ning with the weakest prism and mounting the ladder to t strongest. Dr. Noyes' following remarks are so apposite th we conclude this subject with them: "The true purpose prisms for constant wear or for working is found in tho cases in which the difficulty lies in want of balance betwe opposing groups by which one set predominates too much o the other, not in those cases where the muscular power a whole is below standard. Weakness of all the muscles is se in that tremor or jerkiness which the eyeballs show when fi in some extreme position, or in the sudden jump which t globe makes on reaching a certain point as the eyes foll the finger slowly from one side to the other. The jump com when another combination of muscles is required by the chan

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of fixation, and means that all do not conspire to an equable and smooth action" (Noyes, *op. cit.*, p. 94).

2. To relieve any tendency to vertical diplopia (hyperphoria). The existence and amount of the latent diplopia may be determined by one of the methods on p. 313. Then a prism whose deviating angle equals, or nearly equals, the angle of diplopia may be ordered. Since the degree is generally small, it is not often worth while to distribute the correction between two prisms. If the image seen by the right eye appears highest, a prism should be worn before that eye with its edge downward, just strong enough to bring the highest image to a level with the other; or the same prism with its edge upward before the left eye would amount to the same thing.

Oblique tendencies (hyperesophoria and hyperexophoria) are best resolved into their component horizontal and vertical elements to allow the first to be studied in connection with convergence and the second to be studied independently; but instead of prescribing separately the required horizontal and vertical prisms, a single prism is to be ordered of such a strength and so intermediate in the direction of its apex as to have their combined effect. For formulæ, see p. 324.

3. To correct persistent and incurable diplopia, if of sufficiently small degree. This is done by letting the patient wear a prism whose angle of deviation is equal to the angle of the diplopia, and whose edge is in a direction contrary to the displacement of that false image which is seen by the eye before which it is worn.

4. To train the neuro-motor fusion apparatus to overcome by degrees a curable diplopia, as in paralytic strabismus, or diphtheritic or other pareses. Thus Donders wrote: "We may further, in paresis of a muscle, so far meet the disease by means of a prism, that in order to make the double images which have been brought near one another run together, the muscles will become powerfully tense which, for the alleviation of the paresis, appears to be no matter of indifference" ("Anomalies," etc., p. 134). If one rectus alone be paralyzed, the prism should be worn before the eye of that side, but if a conjugate innervation be affected, each eye should be supplied with a prism. In either case their strength should be such as to relieve that proportion of the diplopia which is beyond the

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control of the fusion function, but not strong enough to let the whole diplopia be overcome without a slight and harmless effort. At regular intervals the diplopia should be measured, to note its gradual decrease and to order weaker prisms accordingly, which will still stimulate the paretic structures, till they regain control of the diplopia altogether, without the further need of prisms.

An undoubted difficulty in this treatment consists in the variations of the relative positions of the images in the different parts of the field of fixation. Schweigger seems to go a little too far in saying: "The correction of diplopia by prisms is indicated only when there exists secondary contraction of the antagonistic muscle, and, as a consequence of that, diplopia throughout the entire field of vision," and "the prisms should be chosen of such a strength as to correct only that part of the diplopia which is due to this contraction of the antagonist" ("Handbook of Ophthalmology," trans. by Farley, 1878). See the Appendix, p. 323.

5. To relieve convergence for near work in some cases of short sight, where it is impracticable to remove the occupation distance, by concave lenses alone, far enough to avoid excessive converging effort. But this application of prisms is very limited, owing to the weight, to the illusory properties, and to the chromatic aberration of the prismatic combinations. Any tendency to divergent strabismus would be aggravated by this method, and even without that tendency being noted, such spectacles should be very carefully guarded from any attempt to employ them in distant vision, even if necessary by surrounding the desk or other scene of work by a light screen at such a distance that the visual axes can never become divergent. For the same reason distant vision spectacles should have their optical centres no further apart than the centres of rotation of the eye; otherwise they cause actual divergence of the axes, the muscular strain of which is perhaps as detrimental to the coats of the eyes as that of excessive convergence. I have seen a myopic patient in whom spectacles prescribed by one of universally recognized skill caused discomfort for years, and were then improved upon by a pair selected at random by himself from a common store; no doubt the refraction was perfect, but the optician had received no intimation of the position of the lenses, and for myopic children

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ecially, spectacles are very apt to be too wide. In some ents, the movements of the elongated eyeballs are so ham- ed that convergent strabismus appears in distant vision divergent strabismus in near vision. In such cases, if the kinds of strabismus are not too extensive, the distant- on spectacles may well have their lenses decentred (not laced) outward, and those for near vision be displaced , if necessary, decentred also) inward. Displacing is, for ant vision, less advantageous than decentring, since it in- eres with the binocular field of fixation which it is here im- ant to preserve. Schweigger says of prismatic spectacles the muscular asthenopia of myopia that "they may be with special advantage when it is possible to employ a king distance of at least ten or twelve inches" (*op. cit.*, 2).

There are other applications of prisms, such as to wear a with their edges inward to enable hypermetropes to ac- modate more easily (a sure way to develop convergent bismus), and Culbertson's prisoptometer, in which a double m is used to reveal anomalies of refraction, but they need detain us. Another interesting use of prisms is to make ifest the presence of what Dr. Stevens calls "habitual un- cious diplopia." The suppressed picture of a flame, as has long known, becomes often manifest on placing a weak n before the eye, even though it be in the direction of ecting the diplopia. In other directions, however, it might cting by creating diplopia. Lastly, it may again be men- ed that prisms should never be prescribed without a fair iminary trial.

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APPENDIX.

TILL attention was kindly called to it by Mr. Charles Wray, F.R.C.S., I was not acquainted with the work of Dr. Stevens, of New York, whose thoughtful papers in the "Archives d'Ophthalmologie" (VI., 6) and the "Archives of Ophthalmology" (Vols. XVI. and XVII.) well repay perusal. They deal with the subject of faulty tendencies of the ocular muscles, not so much from the optical standpoint as with a view to afford surgical relief by a modified form of tenotomy. He has introduced a new nomenclature, as follows:

I.—GENERIC TERMS.

Orthophoria.—Tendency of the visual lines to parallelism.

Heterophoria.—Tendency of these lines in some other direction.

II.—SPECIFIC TERMS.

Heterophoria can be divided into—

(1) *Esophoria.*—Tendency of the visual lines inward.

(2) *Exophoria.*—Tendency of the lines outward.

(3) *Hyperphoria* (*right* or *left*).—Tendency of the right or left visual line to place itself in a direction above that of the opposite side. "This term does not imply that the line alluded to is too high, but only higher than the other, without indicating which of the two is defective."

III.—COMPOUND TERMS.

Tendencies in oblique directions can be expressed in the following manner:

(1) *Hyperesophoria.*—Tendency upward and inward.

(2) *Hyperexophoria.*—Tendency upward and outward.

The designations right and left must be added to these terms. He says: "In registering the respective elements of these compound expressions, I employ the sign ⌊. For example, if we wish to indicate that the right visual line tends

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above its partner by 3°, and that it has a tendency inward of 4°, these facts are inscribed as follows: Right hyperesophoria: 3° ⌊ 4° " ("Archives d'Ophthalmologie," VI., 6, p. 542). The tendencies of the visual lines thus classified must not be confused with actual deviations, as in strabismus. In strabismus, to which he gives the name of heterotropia (τροπος, a turning), there is habitual (conscious or unconscious) diplopia, but in heterophoria (φυρος, a tending) the visual lines only tend to deviate, and are restrained from doing so by extraordinary fusion effort, so that binocular vision is habitually maintained, but at the expense, often, of headaches and other nervous symptoms. These faulty tendencies are, in short, what have long been known as "dynamic (or potential) squint" (Von Graefe), or "latent squint" (Alfred Graefe).

Dr. Stevens retains the old expressions abduction and adduction in their usual sense, as representing the diverging and converging action of an eye, by which it overcomes a prism with its edge out and in respectively, and contributes the new term "sursumduction" for the overcoming of a prism with its edge up or down, and says: "It often happens that the images can be united when a prism is placed before an eye with its base up or down, but that diplopia occurs if the prism is inverted, or if it is placed in its first position before the other eye." The standard distance at which he makes his tests is twenty feet, with the head in the primary position, and any error of refraction corrected, though it does not appear whether the effect of the lenses is accounted for. He says, "The usual power of the abducting muscles in orthophoria is measured by a prism of about 8°, or possibly 9°," and of the adducting muscles by one of 50°, while the powers of sursumduction are normally measured by a prism of 3°. In manifest strabismus, diplopia is generally difficult to demonstrate, owing to habitual suppression of one of the images, but a red glass before one eye, or a weak prism, may make it evident.

Dr. Stevens believes that hyperphoria rarely exceeds 4°, and if any case appears an exception to this, hypertropia is to be suspected, and the suspicion is made almost a certainty if combined with it there is a lateral deviation of more than 6°. Esophoria of more than 10° or exophoria of more than 8° is not likely to be found with maintenance of binocular vision ("Archives of Ophth.," June, 1888, p. 163). His experiments are

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made with an apparatus called a "phorometer." It consists of a vertical standard, supported by a tripod, and adjustable for differences of stature. It bears a hinged arm, which may be horizontal or be used at any inclination notified by a scale of degrees, or it may be folded down altogether. At the hinged extremity it is provided with a spirit-level, and in a groove along its upper surface, carriers bearing prisms can either slide or be removed at will. Instead of simple rectangular prisms, two discs can be used, each consisting of six prisms united at their apices, so that on rotation prisms of increasing strength come before the two visual apertures. A tablet, marked with a small cross on one side and a larger one on the other, is held by a rod at the distance of half a metre from the prisms, or at any other desirable distance. He first places the patient in the primary position, six metres distant from a flame, with the ocular muscles relaxed and any refractive anomaly corrected; and then tests for hyperphoria by a prism, edge out, stronger than can be overcome. If the two images are at different heights, hyperphoria is demonstrated and is measured by that prism which, with edge up or down, brings them to the same level. He next tests for esophoria or exophoria by a prism, edge up or down, too strong to be overcome, and measures the amount of deviation by the prism which, with edge in or out, makes the images vertical. Eyes, therefore, are characterized as eso- or exophoric, etc., when they are shown to be so by tests made at the standard distance of twenty feet, and for the results of near-vision tests Dr. Stevens proposes to speak of "exophoria in accommodation," etc., but this is scarcely precise enough, and it will be better to mention the exact distance of the test, and speak of exophoria at twenty feet, esophoria at ten inches, and so on.

I have drawn up the following series of prismatic tests for cases of suspected nerve trouble from heterophoria:

A.—With Flame at Twenty Feet.

1. With prism of 10°, edge out, or a stereoscope, test for hyperphoria (p. 313).

2. With prism of 4°, edge up, test for esophoria or exophoria (p. 310).

3. Find highest prism, edge out, compatible with single vision (p. 306).

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4. Find highest prism, edge in, compatible with single vision (rarely necessary) (p. 321).

5. Find highest prism, edge upward, compatible with single vision (pp. 321, 322).

6. Find highest prism, edge downward, before the same eye, compatible with single vision (pp. 321, 322).

B.—With Fixation for "Occupation Distance."

1. Find highest pair of prisms, edge out, compatible with single vision (p. 308).

2. Find highest pair of prisms, edge in, compatible with single vision (p. 309).

3. With a prism of 10°, edge up, test for esophoria or exophoria at working distance, using a device to measure the amount, as in Fig. 38 (p. 312).

C.—With Fixation for the Absolute Near Point of Accommodation.

Find the highest prisms, edge in, compatible with single vision of test types, or use Landolt's dynamometer (p. 308). (The usual "finger test," the "cover test," the lateral movements of the eyes, and the distance of each eye from the middle line, are observations which should not be omitted.)

As to prescribing prisms for recent paralytic strabismus, Dr. Noyes puts the matter well in the following quotation: "Double vision which concerns fixation 10° above and for all the field below the horizontal meridian, or which concerns the median region of fixation, is the most distressing, and calls loudly for aid. The office of prisms is usually confined to these regions, namely, on the median line, or for parts, on or below the horizon. In fact, to extend their influence over the whole field is impossible, because the relations of the double images become entirely different in its different parts, and it is impracticable to adapt the prisms to these changes" (*op. cit.*). Dr. Stevens makes an important observation to the effect that slight vertical tendencies (hyperphoria) may modify the adducting or abducting power considerably, and mentions cases in which marked esophoria in distant vision, and exophoria, or even diplopia, in near vision, disappeared after some coexisting hyperphoria had been remedied by a slight tenotomy. We have seen that Dr. Noyes had attributed these

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conditions to general weakness of the ocular muscles, and it is well to bear both causes in mind. Dr. Stevens finds that the whole of a faulty tendency is rarely revealed by a test with prisms, and that part still remains latent, which indeed might have been expected; and says that "instances of even approximate balancing of the eye muscles in anisometropia are rather exceptional," and also that hyperphoria is generally associated with monocular amblyopia, which he attributes to mental suppression of one image during occasional periods of diplopia. This reason appears scarcely valid, for however legitimate it may be to speak of "amblyopia ex anopsia" in cases of complete and long-standing strabismus, we can scarcely suppose that intermittent diplopia could bring it about. Yet were the diplopia persistent the case would not be one of hyperphoria, but of hypertropia. The cause is more probably to be found in the same unilateral defect of development as that to which the anisometropia and the hyperphoria itself are due. Dr. Stevens prefers to perform a very delicate tenotomy for cases of heterophoria rather than to prescribe prisms. Dr. Webster, following in his footsteps, also performs tenotomy, but only when all other means have failed and the nervous consequences of the anomaly are serious. He places the eye under the influence of cocaine, and tests the muscular equilibrium by prisms at intervals through the operation. ("Oph. Review," VII., 363).

An account of some ingenious devices for testing the conjugate tendencies of the eyes will be found in papers by Dr. Ward A. Holden, of Cincinnati, in the "Archives of Ophthalmology," September, 1887, p. 295, and December, 1887, p. 403.

Resultant prisms, as recommended on p. 317, are prescribed as follows: Let R be the deviating angle of the prism required to combine the effects of a vertical and horizontal prism: let V be the deviating angle of the vertical prism, and H that of the horizontal one; then $\text{Sin. } R = \sqrt{\text{Sin.}^2 V + \text{Sin.}^2 H}$; and if r be the angle of rotation from the vertical,

$$\text{Sin. } r = \frac{\text{Sin. } H}{\text{Sin. } R}.$$

We thus obtain both the strength and position of a prism whose effect will be the resultant of the other two, and an ordinary table of logarithmic sines makes the calculation a very brief one.

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ELECTRICITY

IN THE

eatment of Uterine Tumors.

BY

THOMAS KEITH, M.D., LL.D. EDIN.,

AND

SKENE KEITH, F.R.C.S. EDIN.

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ELECTRICITY IN THE TREATMENT OF UTERINE TUMORS.

To Dr. Georges Apostoli.

DEAR SIR:—Will you allow my son and myself to dedicate to you the following account of our first attempts to follow you in your treatment of uterine tumors by electricity? It is all we can offer you for the kindness with which you received us at the various visits we have paid to your clinique. You gave us every information; you put everything at our disposal; the notes of every case treated by you for the last five years were open to us. For all these things accept our hearty thanks.

Since we began your treatment, now more than two years ago, we have ceased to perform any operation on the uterus by abdominal section. For myself, I have always had grave doubts if I were justified in performing such operations at all, especially hysterectomy, for the mortality attending this operation is out of all proportion to the natural history mortality of uterine tumors, and the results of it are out of all proportion to the benefits received by the few. As time went on, and the number of operations became larger, my doubts as to whether I were doing right continued to increase, and that too in spite of the comparatively low mortality with which I was favored, more especially in my private practice. I never had any such doubts as to the propriety of performing ovariotomy, for if ovarian cysts be let alone, death is almost certain, and even that is only reached after great suffering. With hysterectomy it is quite different. Hysterectomy is a hazardous operation for the removal of a tumor that of itself rarely shortens life. The minor operation, on the other hand—the removal of the ovaries—requires no surgical skill for its performance.

It is a great mutilation to a woman, being simply castra-

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tion; and women are beginning to find this out. It is not always successful in attaining its purpose, for you will find in these pages some cases narrated that were cured by electricity, where operations on the ovaries had failed to give any relief.

Your method thus came to me at a very opportune time. You have taken away from me those anxious doubts and fears that had so long vexed me. For this I shall ever feel grateful to you. Leaving out hysterectomy, abdominal surgery is comparatively plain sailing, now that the principle of early operation in ovariotomy is fully recognized. Things are very different in this respect from what they were twenty or twenty-five years ago.

For long, I had hoped much from electricity in the treatment of fibroids, but had only met with disappointment till your method was made known to me. It is in every way a new method, and it belongs to you, and to no other. You have worked in the true scientific spirit. For five years you labored quietly at your clinique, kept up at your own expense, and open to all, before you made your work known. When it was made public, and ought to have had from all a warm welcome, or at least a patient hearing and honest investigation, considering the magnitude of the work, it was received with unbelief and ridicule.

In common with many, I regret the unfair treatment you have received in this country. In spite, however, of the ignorance and prejudice displayed, your work is every day making its way, and it is impossible to resist the accumulating evidence there now is in its favor. That you will in a few years see your treatment adopted all over the world I have little doubt; and no one can wish you success more heartily than I do.

Believe me, dear sir,

Yours truly,

THOMAS KEITH.

IN the following pages we tell, in the simplest language, the story—perfect or imperfect, or merely experimental—of every patient with uterine tumor who, up to the end of last year, submitted herself to be treated by electricity. We have followed Dr. Apostoli's method to the best of our power, and we have always found him an exact and truthful guide. It is

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therefore needless with the ample instructions he has given, to go over the details of his process. Those who are acquainted with his work will easily understand our ways. No attempt at classification of the cases has been made. We leave every one to draw his own conclusions.

Various circumstances have interfered with earlier publication. For long we had doubts as to the permanency of the treatment in the early cases. The later work has been much more satisfactory. But now more than two years have passed, since all operations were given up for this treatment; and our first patient writes—and no one could have had more hemorrhage—that she has been perfectly well all summer, climbing hills and rowing in a boat. Another of the early and doubtful ones, who could never bear a large dose of electricity, tells us, —"I am now in excellent health, without an ache or pain of any kind, and my periods are just a show and nothing more, and give me no discomfort whatever. I hope you have been as successful with all your other patients as you have been with me. But it cannot be otherwise, for I am sure that no one could have been worse than I was with that awful hemorrhage." This patient's importunity had almost driven me into doing hysterectomy for her.

The cases are narrated in the order in which they presented themselves. Every one is given, as well as the amount of every dose of electricity, even in one of the dispensary cases, though only a single application was made. In these dispensary patients there was much trouble and loss of time in finding out their after-history. This was, however, obtained in nearly every case, though it necessitated two special journeys to Edinburgh to search them all out.

About half of the cases that presented themselves were sent away without any treatment, simply because the tumors were giving little or no trouble, or they were near the menopause where no treatment was necessary. At first we fell into the natural mistake of trying electricity on every case that presented any symptoms—in some, when the tumors were almost certainly sarcomatous, and even in one, who was in the last stage of old cardiac disease; still we give every one of these. We know now that the cases best treated are those who are suffering much from hemorrhage—the more the better—cases in which something must be done; cases in which

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two or three years ago, the question of operation of some kind would have been considered by us.

In only a single case during the last two years was hysterectomy proposed and agreed to. The patient was sent by Dr. Dow, of Dunfermline, was 42 years of age, and the tumor had grown for fifteen years. In spite of monthly losses and the size of the tumor—not far off from 50 pounds in weight—she had the management of a large farm, and was able to be out of doors to look after things, summer and winter, by six o'clock in the morning, so little trouble had the huge tumor given her. Till three months before she came, she had suffered nothing. She then had a severe attack of pain over a limited area. We had not at that time much more than begun Dr. Apostoli's treatment, and, considering the huge size of the tumor, it seemed better to advise hysterectomy. This was willingly agreed to, and the operation was arranged for two days after. Next afternoon she lay down after dinner, and the nurse was about to leave her to repose, when she cried out with pain over the heart, and died in a few minutes. How easily we might have had to report a death after operation, or after electricity, had that been tried!

This treatment, it must be remembered, is a new thing. We began it in comparative ignorance. Electricity is known by its results, and, working on the living body, progress and improvement are slow. In the following cases, therefore, are found some failures and some imperfect and incomplete cases; the marvel rather is that there are so few. Time and experience every day correct our want of knowledge and diminish these imperfections. It must also not be forgotten that the cases treated were the worst possible, both as to the size of the tumor and the severity of symptoms. We will probably never again have such a series of bad cases to treat. Those who have practised ovariotomy only during the last twelve or fifteen years, know little what the operation was twenty-five or more years ago, in the early days of abdominal surgery. When patients with uterine tumors come for treatment by electricity, at an earlier stage than they do now, then may reasonably be expected the same ease of cure as is now the case in ovarian disease. The need for the removal of ovaries for small uterine tumors, and of hysterectomy for large ones—except in the rare form of fibrous cystic tumors—will then pass

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away. No large uterine tumor has with us entirely disappeared under the electrical treatment, but in four cases of small fibroids, three of which come into the present series, there is not now a trace to be found. Doubtful cases of simple enlargement have been excluded altogether, though in every one of these the result has been perfect.

The carrying out of this treatment faithfully to the end is not an easy matter, and old tumors that are large, and that have bled for many years, take a long time to improve. The treatment runs away with time, and it requires care and thought. To the surgeon, by far the simpler plan is hysterectomy and the removal of the ovaries. But Dr. Apostoli's treatment saves our patients from risk of life by operation, and saves them also from a horrid mutilation—the one thing that they all dread. We believe it to be the right treatment, and our patients must get it, however great the inconvenience and monotony of it may be to ourselves. Though our results after hysterectomy show the lowest mortality of any yet recorded, and though we have had but a single death after removal of the ovaries for fibroid in almost one hundred operations, we reject even the minor operation in favor of Dr. Apostoli's treatment, and we reject hysterectomy altogether on account of the mortality that has hitherto attended it all over the world. The method given us by Dr. Apostoli is good, and it will endure. We have no fear now of its passing away and being forgotten.

Case I.—Married, age 45, was sent to Edinburgh by Dr. M'Nee, of Inverness, for operation in the month of June, 1887.

We had determined to give Dr. Apostoli's treatment a fair and extensive trial, and advised this lady to wait until the apparatus arrived. Fortunately her husband, who was much troubled with stiffness and pain due to rheumatism, had received much benefit from the faradic current, and was therefore a believer in electricity. They were willing to do anything to avoid the risk and anxiety of an operation, even to be experimented upon, so far at least as to be our first case. Her history was as follows: She had never been pregnant, and up to the age of 40 had enjoyed good health; the periods were regular, and were not in excess. Between the age of 40 and 41 there was a change. The time the flow lasted began to be

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prolonged, and the quantity of blood lost steadily increased. Keeping pace with this, the general health began to suffer, she became breathless and anæmic, and for some time past the discharge has continued for about two weeks, and has returned sometimes after an interval of one week, sometimes after an interval of two weeks, but she is never dry for longer than two. She has to remain in bed for at least one, and sometimes for two weeks at a time, or, in other words, from three to six months in the year. While lying in bed she is afraid to do anything for herself, as even the simple raising of the arms above the head will cause a sudden rush of blood from the womb. After the period she is unable to walk up-stairs without assistance. When the bleedings began to be severe she took ergot in large quantities with marked benefit for a time. Of late, however, it has not been of service, except that she thinks that perhaps the bleeding would have been worse had the drug not been taken. About the beginning of the year the tumor was first noticed.

The patient is very anæmic and breathless; and on examination the tumor is found to extend to fully three inches above the pubes. The cervix is situated far back, and there is some difficulty in passing a sound to a depth of three and three-quarters inches. It was evident that this was a case for the use of the positive pole in the uterine cavity.

June 15th, 80 milliampères for 6 minutes. Fortified by what we had seen at Dr. Apostoli's clinic in Paris, we allowed the patient to walk home to her apartments, a distance of perhaps 300 yards. Next day the patient was found to be certainly not any the worse, and a slight bloody discharge had stopped. 18th, 100 milliampères for 5 minutes. This application was again well borne, no pain being complained of. 20th, 90 ma. for 6 minutes. 22d, 100 ma. for 10 minutes. Feels very well indeed. 23d, there was a little bleeding from the uterus in the morning, which stopped by mid-day. 24th, slight bleeding all day. 25th, the third day of the period, and the patient is in the best of spirits, and although not in bed, has less discharge than for several years. 26th, still very well. 27th, the flow increased during the night, and is still bad. 28th, flow still severe. 29th, much less during the night; free during the day. 30th, much the same as yesterday.

July 1st, no bleeding since last night. 2d, 120 ma. for 8

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minutes, followed by bleeding at night. 5th, 120 ma. for 8 minutes. 8th, 9th, and 11th, 120 ma. for 10 minutes. 13th, 90 ma., and 15th, 95 ma. for 8 minutes each. Feels very much stronger and better in every way. 18th, 80 ma. for 8 minutes. 20th and 22d, 90 ma. for 10 minutes. 25th, 85 ma. for 10 minutes. 27th, the period has come on to-day, after an interval of nearly four weeks. This is a longer space than for three or four years.

August 8th, 90 ma. for 10 minutes. The period has lasted but six days, and the bleeding was severe for a few hours only. Does not feel much pulled down. 10th, 90 ma. 12th, 95 ma. 15th, 95 ma. 17th, 80 ma. 19th, 90 ma. for 10 minutes each.

The patient went home after this, the twenty-first sitting, in the best of health and spirits.

After-history, taken from letters from patient's husband to us:

November 17th.—"I beg to inform you that Mrs. R. has passed through another of her periods, which was longer in duration than the two former ones, although accompanied by less hemorrhage. It commenced on Saturday the 5th, and was scarcely noticeable for three or four days, after that it was more perceptible, until the 15th, when it vanished. The last two days there was very little. She did not go to bed during the day, and feels quite strong now."

December 22d.—"I am glad to say that your treatment has made her like another person."

January 27th, 1888.—"I am happy to inform you that Mrs. R. has just passed through another of her monthly periods, very easily, something similar to what used to be previous to her tumor affliction. She had not to go to bed during the day, and now feels quite strong."

August 27th.—"Mrs. R. desires me to acknowledge receipt of your kind note of inquiry, dated 24th inst., and to thank you very much for your remembrance of her case, and to say that her February period was light; March, April, May, June, and July, scarcely any bleeding; but during her August one a good deal, which was not to be wondered at, seeing there was next to nothing the five previous months."

September 7th.—"Mrs. R. had arranged to have her photograph taken on Saturday last, the 1st inst., but her Sep-

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tember period coming on prevented her. She wished to have a card freshly taken to show you how ruddy and well she was looking; but this turn has made a very great change on her—she is now white and weak.

"The first day there was not much bleeding; the second there was more; on the third, fourth, and first half of the fifth there was much—very much; but less and less every day since."

October 24th.—"Since I wrote you about Mrs. R., her October period has come and gone. She was not nearly so bad this time, although there were five and a half weeks between the October and September ones. Mrs. R. desires me to inclose her photograph, which, I think, will testify to her being in pretty fair health."

January 21st, 1889.—"Since I last wrote you on the 24th October, Mrs. R. has only had one slight—very slight—period, and that on the 17th November; thus nine weeks have passed without any indication of another. She is in good health and spirits."

It is interesting to note that there is not any mention of the condition of the tumor. The tumor itself was evidently considered of no importance as long as it did not give rise to symptoms. A thoroughly sensible view of the case.

Unfortunately, we cannot be sure that the strength of the currents recorded is correct; but there is certainly not a difference of 20 ma. either way.

CASE II.—Married, age 60, was in the habit of appearing every few months in the ward, which was at that time set apart for the treatment of ovarian and uterine tumors in the Royal Infirmary, Edinburgh.

She had had a tumor in the abdomen for at least twenty years. This mass had not followed the usual history of these growths, for it had continued to increase in size after the menopause. The last period was eight years ago. In March, 1887, the old lady insisted that the tumor was growing, and that it was giving her much more inconvenience. She complained much of difficulty in walking and of dyspepsia. Careful measurements of the tumor were made in order to determine whether there were any increase in size or not. The circumference was 42 inches at the level of the umbilicus. In the month of June the circumference was still 42 inches; but other measurements showed a slight but decided increase in

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size; and as she complained more than ever of the pain in the left side, for which pain, by the way, she had had plenty of treatment from one and another doctor, it seemed to be a fair case upon which to try the electrical treatment. In the pelvis the vagina was found to be drawn out into a funnel toward the left, and the cervix could not be reached. The case was thus evidently one which would require to be punctured, and where the puncturing needle would be connected to the negative pole of the battery. Owing to the reason which will be described later on, the treatment had, in this case, to be limited to five applications, and the strength of the currents used is possibly not correctly stated.

June 21st, 1887.—A current of about 80 ma. was passed for 5 minutes from the clay pad on the abdomen to the exposed point of the needle, inserted into the tumor from the vagina. The passage of the current caused simply a little discomfort. On withdrawing the needle there was not any hemorrhage. The vagina was washed out, and a pad of iodoform gauze pushed against the spot where the puncture had been made. The patient walked home, and next day felt none the worse.

On the 27th, a current of 100 ma. was passed through the tumor in the same way and for 7½ minutes. A little more pain was caused by the treatment. The circumference was found to have diminished 1 inch. She felt much better for this application, and on her way home, and when passing through a garden, said to a friend who was with her that she felt as if she could dance on the grass.

On the 4th of July the circumference was 40½ inches. On the 7th, the strength of the current was about 60 ma., and was not so well borne. On the 11th, the application was again borne badly, the strength being about 40 ma. The circumference was 40 inches.

On the 15th, it was not possible to puncture the tumor with safety. The appearance of the abdomen was much changed, the tumor was more nodular, appeared to be smaller, and could be pushed somewhat from one side to the other, instead of being immovable as it had previously been.

19th inst.—A current of 70 ma. was passed for 7½ minutes. The patient was in great spirits, for she had, the day before, taken in her stays instead of letting them out, as had been necessary for a number of years.

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On the 12th August, failed to find a spot where the pelvic part of the tumor could be punctured, as it had become much smaller and was entirely protected by the bladder. Much to the disappointment of the patient the treatment must be discontinued in the mean time at least. She has, however, gained much; she can walk better, and has not any difficulty in going her own messages and attending to her house; she can eat well, and in every respect feels decidedly better.

November 19th.—The circumference is 39½ inches.

February 23d, 1888.—Still keeps well, seven months after this short course of treatment.

In August, became hemiplegic, and has not been heard of since.

CASE III.—Married, age 31, came to the Woman's Dispensary, Edinburgh, in July, 1887.

This patient had been married for three years, and had never been pregnant. Before marriage she noticed that her monthly periods were becoming prolonged, and that she was losing more blood than formerly. Now, the flow lasts a week instead of one or two days. For nine months there has been a feeling of bearing down, and also a constant gnawing pain in the right groin. She has four sisters, none of whom have had any trouble with their uterine functions.

On examination in the vagina, the os uteri is felt to look forward, and on placing the hand on the abdomen the uterus is found to reach to 2 inches above the pubes. The sound passed directly backward, and then slightly forward, to a depth of 2½ inches. On depressing the handle, however, it slipped in fully ¾ of an inch farther.

Treatment.—Until the end of November the current strength is not absolutely correct.

July 7th.—80 ma. for 5 minutes. On the 15th the patient came to say that she was menstruating, and that, although she felt very tired the day after the application, she was now feeling better than usual. 22d, 50 ma. for 5 minutes.

August 8th, 60 ma. for 5 minutes. Was not much inclined to have the application to-day, as she considers herself cured, and, against advice, does not intend to come back. However, as there was some return of the pain toward the end of the month, the treatment was resumed. 29th and 31st, 80 ma. for 5 minutes.

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September 5th, 60 ma., and 16th, 40 ma. for 5 minutes each. The pain is better. The period is over, and as there has been more blood lost even than usual, the internal electrode will be positive instead of negative, as heretofore. 19th, 40 ma. 21st, 60 ma. 26th, 40 ma. 28th, 40 ma. for 5 minutes each.

October 3d, 40 ma. 5th, 40 ma. 19th, 40 ma. for 5 minutes each. Again there has been too much flow during the period. In other respects the patient is well. 26th, 40 ma. for 5 minutes.

November 2d, 80 ma. 9th, 80 ma. 23d, 60 ma. 25th, 60 ma. 30th, 75 ma. for 5 minutes each.

December 2d, 75 ma. 5th, 90 ma. 9th, 100 ma. for 5 minutes each.

January 9th, 1888, 75 ma. for 5 minutes. There has been less flow at the last two periods. 14th, 75 ma. 20th, 65 ma. 23d, 65 ma. 27th, 75 ma. for 5 minutes each.

February 6th, 100 ma. for 5 minutes. The tumor has become very much less, and cannot now be felt from the abdomen. 11th, 100 ma. 22d, 140 ma. 27th, 130 ma. 29th, 160 ma. for 5 minutes each.

March 2d, 200 ma. 5th, 190 ma. for 5 minutes each. No enlargement of the womb can now be detected, and the sound enters barely to the extent of 2½ inches. Thirty-five applications in all. In September there was not any pain, the periods were normal, and the woman had gained weight, and said that she felt quite well.

CASE IV.—Single, age 43, was admitted into the Royal Infirmary, Edinburgh, in December, 1886.

For three years the patient says that she has been subject to great losses of blood every month, and has become weak and ill. In August of this year two soft red masses the size of the fist were passed from the vagina. A month afterward, Mr. Teale, of Leeds, dilated the cervix and removed part of a soft friable tumor, which he was much inclined to think was malignant. For a month or two there was improvement, but by December the patient was as ill as she had been before.

December 16th.—During the night two large masses, weighing half a pound, of what appeared to be firm clot were passed. These were examined by Dr. H. A. Thompson, and were found to consist of partially organized clot. There has been profuse discharge to-day, accompanied by severe pain, and the tumor,

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instead of being smaller, is fully two inches higher than it was before.

December 19th.—The discharge is less, and the tumor has gone back to its former size.

December 29th.—Another large piece of partially organized clot was passed.

January 6th, 1887.—The ovaries were removed, the usual number of students being present. The left ovary was got away with difficulty on account of omental adhesions. On the right side the ovary was close to the tumor. The Fallopian tubes were also removed. There was not any disturbance after the operation, the pulse never being quicker than 84, and the temperature was normal throughout.

February 3d.—The tumor is swelled up.

February 5th.—The period has come on, and a mass has been passed from the vagina.

February 10th.—Went home, there having been much less discharge than usual.

June 17th.—Was admitted into hospital again. The patient has not been better for the operation. There has been scarcely any hemorrhage, but there is a constant and very profuse discharge with very offensive smell, and occasionally a clot is passed. The temperature is fully 102°. The patient does not look so well as she did after the operation, and is very anæmic. The os uteri is dilated to the size of a shilling, and projecting from it is a sloughing mass. The tumor extends to midway between the pubes and umbilicus.

June 19th.—The whole of the sloughing part of the tumor was removed, and as much as possible of the remainder. It was not considered advisable to entirely empty the uterus, as the bleeding was profuse and the patient was much debilitated. The temperature fell at once after the operation.

July 9th.—As ordinary surgical remedies seemed to be useless, it was thought that it was worth making the experiment of treating the case by electricity. Cavity measures 4½ inches. 9th and 11th, 60 ma. for 5 minutes. There is less discharge, and the patient says that she feels stronger. 13th, 75 ma. 15th, 80 ma. 18th, 60 ma. 21st, 60 ma. for 5 minutes each. Is feeling so much stronger that she went out for a walk yesterday. 26th, 60 ma. for 5 minutes. Walked a mile. 28th, 60 ma. for 5 minutes.

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ugust 16th, 40 ma. for 5 minutes. The temperature rose
1 to 102°, caused by a sloughing mass again protruding
ugh the os. This was removed and the temperature fell.
sound was made positive to-day instead of negative, as it
been previously. 18th, 20th, and 23d, 40 ma. for 5 minutes.
eptember 8th, 40 ma. for 5 minutes. Sloughing mass was
ved six days ago, and to-day the patient walked a mile
before and after the treatment. 10th and 13th, 60 ma. for
utes. Says that she feels stronger than she has done for
y years. 17th, 80 ma. 20th, 90 ma. 22d, 50 ma. 24th,
na. for 5 minutes each. The cavity measures 3½ inches.
120 ma. 29th, 80 ma. for 5 minutes each. A clot the
of a walnut came away. This is the smallest that there
been. The uterus is now scarcely larger than normal.
ctober 1st, 4th, 6th, 8th, 11th, 13th, 18th, and 20th, 120 ma.
minutes. Patient left hospital and reached home very
ortably. She was so well that people in the village
ded round her to see for themselves the change in her
ition. She kept well for about two months; then wrote
he 27th December to say that she was not so well, and
the discharge had begun again. On the 12th January,
she came back to the hospital. The tumor reached as
as the umbilicus, and the part projecting through the
as again sloughing. The temperature was 102.2.°
anuary 12th and 14th, 200 ma. for 5 minutes. A large mass
away yesterday. The sound was made negative. 17th,
na. 19th, 275 ma. 21st, 260 ma. 26th, 160 ma. for 5 min-
each.
t first the patient improved, but now the intra-uterine
has again begun to slough, and there is again fever. On
unt of the feverish condition the treatment had to be dis-
nued, as the Edinburgh Royal Infirmary was not pro-
with a suitable battery, and we did not have, at the
a portable one. Toward the end of March, however, it
thought better to allow the patient to run the risk of
for the treatment, as we had arranged to leave Edin-
h.
arch 22d, 100 ma. 24th, 125 ma. for 5 minutes each. The
was again made positive. 27th, 210 ma. 29th, 150 ma.
170 ma. for 5 minutes each.
pril 2d, 3d, and 5th, 170 ma. for 5 minutes.

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There was decided improvement, and on leaving Edinburgh, Dr. Stirton, of the Glasgow Royal Infirmary, kindly consented to take charge of the case. After a few weeks in Glasgow she got homesick, and so anxious to get home that she risked the long journey, and died a few days afterward. What was the exact pathological condition it is impossible to say; it was certainly not the ordinary submucous fibroid condition, the material which was removed on several occasions resembling in appearance a mucous polypus more than anything else. It is not of much use to speculate on what might have been had things been different, but it is at least possible to believe that life, which was prolonged for six months or more by the electrical treatment, might have been permanently saved had the treatment in 1887 been continued for a greater length of time; that is to say, if the growth was not of a malignant nature.

CASE V.—Married, age 42, was sent home by Dr. Turner, of Gibraltar, for hysterectomy. There is nothing of particular interest in the previous history of this case. For several years a fibroid of the uterus had been slowly undermining the general health, although there was neither hemorrhage nor any other of the usual symptoms an uterine fibroid gives rise to. She could not walk without the assistance of a stick in one hand and some one on the other side to help her along; but an extract from a letter of Dr. Turner's will give perhaps the best idea of her condition before the treatment was commenced: "I have to thank you for your kind note regarding Mrs. ——, and to express my great satisfaction that you have found her case possibly amenable to less hazardous treatment than the operation of extirpation. Her condition at one time, about three months ago, was such that her life seemed seriously threatened, and I doubted whether she would ever be able to stand a journey to England. I did not hesitate to recommend her undergoing the operation provided she got sufficiently well to travel. Before leaving Gibraltar she had improved considerably, and possibly the voyage home has done her good. I shall be most grateful if, by means of the electric current, you are able to stay the growth of the tumor, and enable Mrs. —— to tide over the few years that remain until the menopause."

The case did not appear to be a very suitable one for treat-

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ment; but as every case of fibroid giving rise to symptoms had to be treated after the same plan, this one had to be taken like the rest.

The tumor extended to one inch above the umbilicus on the right side, and scarcely so high on the left. It came very low down into the pelvis, and the cervix was drawn up toward the left side and nearer to the pubes than usual.

Treatment.—As there was not any bleeding, the negative pole was placed in the uterine cavity and the current passed through from the abdomen. It was on every occasion badly borne, and even in the very weak doses which were used caused some pain. The strength of the currents used during the first course of treatment is only approximately correct.

July 9th and 11th, 1887, 40 ma. for 5 minutes. 12th, feels decidedly better and stronger. The tumor barely reaches up to the umbilicus, and the patient herself thought that she was smaller. 13th, 40 ma. for 5 minutes. 14th, slept last night in a dress, the band of which she could not fasten a week ago. 15th, 40 ma. for 5 minutes. Was able to take a walk without any support. 18th, 50 ma. for 5 minutes. 21st, the period has been on for two days. There was not any discomfort, although formerly she felt it coming for a week before it appeared. The tumor swelled up a little, but is now small again, and the patient says that her dresses are too wide. 26th, 40 ma. for 5 minutes. Walked two miles yesterday without fatigue. 28th and 30th, 40 ma. for 5 minutes.

August 1st and 6th, 50 ma. for 5 minutes. Feels splendidly well. The tumor is now fully 2 inches below the umbilicus, but it is also somewhat lower down in the pelvis. The abdominal wall is decidedly fatter. 8th, 11th, and 18th, 40 ma. for 5 minutes. There has not been any discomfort with the period; there has been less flow, and the patient feels perfectly well. The tumor is fully 3 inches below the umbilicus, and there is not so much of it in the pelvis. She looks a new woman.

On October 3d the patient wrote from Eastbourne that she was feeling very well, although she had required to keep her bed for some days while in London, as she had been much exhausted by the shaking of an hour's drive in a cab.

Had we known what we know now, we would never have thought of allowing this patient to go home, especially to

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such a distance, after only thirteen applications, and we were not surprised to hear from Dr. Turner in June, 1888, that the tumor had begun to grow. She was very fairly well, but was afraid that she might return to the unhappy state from which electricity had rescued her. She therefore came back to England in the beginning of July.

July 3d, 1888.—Mrs. —— looks well, and walked alone from Victoria Station, about a mile. The tumor extends up to the umbilicus, and is not so large in the pelvis as it used to be. The sound passes with much greater ease than it did last year. 30 ma. for 5 minutes. 5th, 65 ma. 7th, 50 ma. 10th, 50 ma. 12th, 60 ma. 14th, 55 ma. 17th, 50 ma. 21st, 60 ma. for 5 minutes each. The period is just over, and there is a greater diminution in size of the tumor than this would naturally account for. 24th, 50 ma. 26th, 55 ma. 28th, 55 ma. 31st, 75 ma. for 5 minutes each.

August 2d, 75 ma. 4th, 70 ma. for 5 minutes each. The tumor is decidedly less, and the patient feels very well and strong. 6th, 60 ma. 11th, 50 ma. 14th, 70 ma. 21st, 70 ma. 23d, 90 ma. 25th, 65 ma. 27th, 85 ma. 29th, 95 ma. 31st, 105 ma. for 5 minutes each.

September 3d, 110 ma. 5th., 115 ma. 7th, 130 ma., for 5 minutes each. The tumor is 2 inches below the umbilicus, and is very much less prominent than it has ever been. 17th, 60 ma. 19th, 65 ma. 21st, 120 ma. 22d, 100 ma. 24th, 75 ma. for 5 minutes each. Yesterday was Sunday, and Mrs. —— was out for eleven hours; at church twice at least, and paying visits the rest of the time. 26th, 140 ma. 28th, 100 ma. 29th, 220 ma. for 5 minutes each.

The tumor is small—2 inches below the umbilicus—and the patient says that she is in perfect health.

Case VI.—Single, age 47, was seen in 1885 with a large uterine fibroid.

Patient was first aware that she had a tumor at about the age of 35, though before that time she found that her monthly periods were increasing in quantity. There is always pain, sometimes at one side, sometimes at the other, always aggravated every month. The periods, often floodings, now last six days, and recur every two weeks. For several years she has scarcely ever missed a month when it did not become necessary to afford relief to the bladder by means of the

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catheter. The woman says that she is willing to run any risk, no matter how great, which would give her a chance of comfort. The appearance of the woman is peculiar, as her waist, or at least the part round which her petticoats are fastened, is situated immediately below her arm-pits. She has difficulty in getting about from the weight, and the legs are always swollen.

The tumor itself was large; it was slightly irregular, and extended beneath the ribs and sternum, raising them greatly. It is not possible to say how high the upper margin of the tumor reached to; but it really appeared that there would be little room in the chest for the thoracic organs. Within one inch of the vaginal outlet the finger came on a round smooth mass as hard as stone, which was jammed tightly in the pelvis. No cervix could be felt, and the finger could not be passed for any distance on account of the jamming of the tumor. The urethra measured 5 inches, and the bladder was situated high up on the left side of the abdomen. The retention of urine at the periods was easily explained, as it was evident that even slight swelling of the tumor would close the urethra by pressing it against the symphysis pubis. There was complete immobility of the tumor both in the abdomen and in the pelvis. The weight of the mass was probably nearer 40 than 30 pounds. After beginning the treatment of such growths by electricity, I called on the woman and suggested that she should try it, as it could hardly make her any worse than she was. She was sceptical, but allowed herself to be persuaded.

The electrical current could only be passed through the tumor by puncturing the mass in the pelvis. The negative pole was connected to this instrument. Owing to the occupation of the patient, the treatment was prolonged over many months. She had difficulty in getting away from her business. She was proprietress of a small shop, and she could not afford to get any one to look after it oftener than once a week or so. During the whole of the time she was not confined to her bed even for an hour, and was always to be seen in her shop, except for the hour or two when she left it to come for the treatment.

The strength of the current recorded at the first eighteen sittings is approximate only.

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July 11th, 80 ma. 15th, 150 ma. for 5 minutes each. The patient feels much as she did; but the tumor seemed to be slightly movable. 19th, 90 ma. for 5 minutes. Says that she is no worse. 22d, 80 ma. for 5 minutes.

August 12th, 80 ma. for 5 minutes. She thinks that she can walk a little more easily. The period is over, and was much the same as usual; no better, and not any worse. There is now room to pass the finger up to the cervix. 16th, 40 ma. for 5 minutes. Walks more easily. The tumor is more movable, and is smaller and more lobulated. 20th, 40 ma. for 5 minutes. 28th, the period came on without any pain; there was more bleeding, and the catheter had not to be used. This has been the most easy time for many years.

September 2d, 45 ma. for 7 minutes. 5th, 40 ma. 13th, 40 ma. 20th, 40 ma. for 7½ minutes each. There is now marked decrease in the size of the tumor. 26th, 40 ma. for 7½ minutes.

October 17th, 40 ma. for 7½ minutes. There was much less flow this time; it was bad for one day only. However, the catheter was required. The tumor is now free of the ribs. 24th, 60 ma. for 5 minutes.

November 9th, 70 ma. for 7½ minutes. There has been rather more flow again, but the catheter was not required. The tumor continues to diminish in size; it can be pushed about, and has become very much lobulated. 16th, 40 ma. 24th, 40 ma. 30th, 70 ma. for 7½ minutes each.

January 16th, 1888, 125 ma. for 10 minutes. The period was passed through without pain, discomfort, or retention. 26th, 150 ma. for 5 minutes.

February 7th, 100 ma. for 5 minutes.

March 26th, 100 ma. 29th, 150 ma. 31st, 150 ma. for 8 minutes each.

April 2d, 150 ma. 4th, 150 ma. 6th, 150 ma. for 5 minutes each. The course of treatment thus consisted of thirty applications. Thirty punctures were made into the tumor from the vagina. On one occasion only was there any bleeding from the wound; it stopped, however, before half a teaspoonful of blood had been lost. Every puncture opening had healed before another was made, and it would have been impossible for any one to know that there had been any solution of continuity.

For the reason stated, the treatment extended over a

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period of nine months. Almost from the beginning there was improvement, and during the whole time there had been retention on only two occasions. The floodings had entirely ceased, and the tumor had decreased in size in a marked degree. Owing to the fact that a large part of the tumor was concealed by the chest-wall, it is difficult to say by how much the mass became smaller; but probably it was considerably less than half the size it was before being treated by electricity. A complete relief from pain had also been obtained. In September she was very well; there was not any pain, there was less discharge at the periods, and there had been no occasion for the use of the catheter. The tumor was about the same size as in April.

January 19th, 1889.—The tumor is gradually becoming smaller, and there is a great change for the better in the figure. The periods last three days, and recur every four weeks; there is not any pain; there has not been any retention; she feels quite well, and sleeps better than she used to do, and is quite satisfied, even although there is still an inert mass in her abdomen.

CASE VII.—Single, age 37.

Until the beginning of the year 1882 this lady was well. About that time she began to have menstrual trouble; there was pain and also increased loss. For three and a half years these symptoms became steadily worse, and for a week or ten days in every month the lady was in the habit of leaving her own house and going to a sort of private hospital. She herself was mainly responsible for her troubles, as she allowed that she had declined having anything done.

When she came under our care in July, 1887, she was really ill and was constantly suffering. There was a feeling of fulness, great irritability of the stomach, profuse watery discharge, and great pain and feeling of pressure on the bladder. In addition, there was a great loss at the periods, and at those times all the symptoms were much aggravated, more especially the bladder pain and the irritability of the stomach.

On examination it was found that the tumor reached up to the ribs, and on passing the finger into the vagina, it was felt within half an inch of the outlet. The mass was particularly soft, and so completely filled the pelvis that the finger could not be passed up any distance to feel for the lips of the

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fully dilated cervix. The vaginal outlet was small, and enucleation of a mass, weighing probably ten pounds, would have been attended by great danger, more especially as the anterior wall of the uterus was found, later on, to be much thinned.

The patient was very much against operation, and was thankful to try what electricity could do for her tumor, though she was made aware that no benefit might accrue from the treatment. Of course, it was only possible to puncture the mass. On all occasions this was done and the needle made negative.

July 13th, 1887, 60 ma. 15th, 80 ma. for 5 minutes each. There was not any discomfort after the first application, except that there has been more of the watery discharge. 18th, 60 ma. 20th, 65 ma. 22d, 75 ma. for 8 minutes each. 24th, the period has come on with the usual retention and pain. The ordinary dose of morphia required by the patient at those times, viz., three-quarters of a grain hypodermically, has been required.

August 8th, 60 ma. for 5 minutes. 11th, 80 ma. for 8 minutes. 13th, 100 ma. for 5 minutes. The pelvis does not seem to be so tightly filled by the tumor. 16th and 25th, 60 ma. for 8 minutes. Morphia was required as usual at the commencement of the period, but the catheter had not to be used. 27th, 120 ma. 30th, 100 ma. for 8 minutes each.

September 1st, 80 ma. for 8 minutes. 3d, 100 ma. for 10 minutes. 17th, 50 ma. for 5 minutes. There was not so much pain as usual. The tumor is now scarcely above the umbilicus, and the finger can be pushed up between the pelvis and tumor, until the anterior lip of the cervix is reached, situated in the abdomen above the pubes. 20th, 80 ma. 22d, 120 ma. 24th, 110 ma. for 5 minutes each. 27th and 29th, 120 ma. for 7 minutes. Is feeling more comfortable and lighter.

October 1st, 120 ma. for 5 minutes. 11th, 120 ma. for 7 minutes. The period has been very much as usual. 13th, 15th, 18th, 20th, 22d, and 25th, 120 ma. for 7 minutes.

November 3d, 5th, and 8th, 120 ma. for 7 minutes. 10th, 12th, and 15th, 120 ma. for 15 minutes.

December 3d, 200 ma. for 7 minutes. The period was scarcely so bad as usual, and the patient was in bed for three days only. Gaiffe's galvanometer was used. 6th, 180 ma. for 10 minutes. 8th, 230 ma. 10th, 190 ma. for 15 minutes

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each. 13th, 215 ma. for 12 minutes. 14th, 245 ma. for 15 minutes. 31st, 200 ma. for 10 minutes.

January 3d, 1888, 210 ma. for 15 minutes. 5th, 150 ma. 7th, 200 ma. for 10 minutes each.

February 22d, 175 ma. for 5 minutes. Has been confined to the house with a cold. 24th, 200 ma. 27th, 175 ma. 29th, 150 ma. for 5 minutes each.

March 2d, 120 ma. for 5 minutes. 5th, 150 ma. for 8 minutes. The tumor is at least one-third smaller, and reaches up to the umbilicus when it is swelled before a period. We considered that we had probably gained as much as we could by means of electricity, and that both the difficulty and danger of operation had been much lessened. The lady could not make up her mind to have an operation at that time. She came up to town in June, and we found that there had not been any change in the tumor since March. After a couple of days in town her courage went, and she had almost to be coerced into submitting to enucleation.

June 7th, the tumor, weighing almost five pounds, was removed piecemeal, and the lady went home to Edinburgh on the twenty-second day.

This case bears out to the letter what is claimed for electricity: it reduces, but does not cause the disappearance of a tumor.

Case VIII.—Married, age 48, seen with Dr. Dunsmure.

This lady has been bleeding badly for twenty years. She has often been plugged; she has often had iron and various other styptics injected, but still she bleeds; and in spite of all treatment the bleeding and general health become worse every year. There is now scarcely any period, as the bleeding is almost continuous.

The patient is a big, fat, soft woman, very anæmic and breathless. Her heart is in a bad condition: it is dilated and fatty, and the purple venous radicles in her cheeks show that it is not able to do its work properly. She is also subject to attacks of diarrhœa. She is very weak, and altogether in a bad state. As there was not any sign that the bleeding would stop of itself, it was determined to commence the treatment without delay, as every day seemed to be of importance The lady was much disappointed when she heard that the treatment could not be carried out in her own house. The strength of the current registered is not exact.

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The patient was so fat that it was difficult to make out the upper margin of the tumor, more especially as any pressure on the abdomen interfered with her breathing. The os was patulous, and the sound passed to a depth of six inches.

July 14th, 1887, 100 ma. for 7½ minutes. 16th, 100 ma. 19th, 65 ma. for 5 minutes each. 21st, 80 ma. for 10 minutes. There has not been any bleeding for two days, the first time it has stopped for the last twelve weeks. 23d, 40 ma. 25th, 60 ma. 27th, 60 ma. for 10 minutes each. There has been no return of the bleeding. 29th, a message was sent to say that the patient was unable to come for treatment, as she had caught cold while out driving the day before, and had been seized with a bad attack of diarrhœa during the night. 30th, Mrs. C. became collapsed, and died early this morning. It was a great disappointment, as the case promised to be a most satisfactory one, and but for the attack of diarrhœa would doubtless, in spite of the great exhaustion and anæmia, have done well.

CASE IX.—Married, age 43; commenced the treatment by electricity in July, 1887.

In February, 1886, Dr. Keith was consulted as to the advisability of operation, and strongly advised the patient to wait for a time, as the local difficulty in the removal of the tumor would have been great. There were about 4 inches of fat on the abdominal wall, and a great deal of enucleation would have been required low down in the pelvis. If the tumor grew, operation would have been much more easy, as the wall would have been stretched, and there would therefore be more space to work in. The patient herself was very anxious to have something done.

Some extracts from a diary kept by this lady give one an idea of her misery. One entry says, "Quite a busy week; out shopping; feel so thankful to be able to move about." The next day, however, she is in bed again. Another, "Only seven days—how thankful I am."

June 18th, 1886.—"I feel miserable. A burden to myself, and no use to anybody."

The lady was stout and very anæmic, and, when well, was unable to walk far on account of breathlessness. She says that she often bleeds for a month at a time, and is seldom dry for more than a week. The tumor extends up to the ribs,

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and fills the abdomen except in the left flank. The interior of the cavity was tender, and the passage of the sound caused pain until about half of the treatment had been gone through. The depth of the cavity was 7 inches at least.

The case was an instructive one to a beginner. The patient was, after the first few applications, extremely sensitive to the electrical current, and it was not until the treatment was almost finished that anything approaching large doses were given. During the first four sittings the sound was made negative; during the remainder it was positive.

July 14th, 16th, and 25th, 80 ma. for 5 minutes. The period is over, and as the flow was profuse for only three days, the lady, who is a woman full of spirits, thinks that she is to be quickly well. 28th, 80 ma. for 5 minutes.

August 11th, 80 ma. for 5 minutes. After an interval of one week the flow appeared, and the loss has been greater than it has been for the past eight months. 13th, 70 ma. 16th, 40 ma. for 5 minutes each. The tumor scarcely reaches above the umbilicus and the patient feels very well. 25th, 40 ma. for 5 minutes. The third period within less than six weeks is over. There was scarcely as much bleeding as last time, but still it has been bad. The tumor is swelled up to within an inch of the ribs. 27th, 40 ma. for 5 minutes. Two days afterward the period again came on, for the fourth time in exactly six weeks. The lady and her husband are both much discouraged, and are rather inclined to stop treatment; and the matter is to be compromised by her going to the country for a month.

October 6th, 40 ma. for 5 minutes. The patient is decidedly better. The last period continued for five, instead of the average of thirteen days. The tumor is not so prominent. 8th and 11th, 40 ma. for 5 minutes. The patient says that she feels "awfully well." 13th and 15th, 35 ma. for 5 minutes. 17th and 19th, 30 ma. for 5 minutes. 22d, 35 ma. 24th, 40 ma. for 5 minutes each. 26th, 28th, and 31st, 40 ma. for 7 minutes.

November 2d and 15th, 40 ma. for 7 minutes. The first period since the lady came home from the country is over. It did not appear until ten days beyond four weeks, lasted six days, and was never in excess of the natural. 17th and 19th, 70 ma. for 7 minutes. 22d, 70 ma. 24th, 75 ma. for 10 minutes each. 26th, 30 ma. for 7 minutes. Gaiffe's galvanometer was used to-day. 29th, 75 ma. for 10 minutes.

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December 1st, 65 ma. 3d, 85 ma. 6th, 75 ma. 15th, 100 ma. for 10 minutes each. The period has lasted five days, and was bad for two. 17th, 100 ma. 20th, 125 ma. 22d, 125 ma. 24th, 140 ma. 27th, 140 ma. 29th, 125 ma. for 10 minutes each.

January 10th, 1888, 170 ma. for 10 minutes. The period has lasted six days; three of them bad. 12th, 165 ma. 14th, 160 ma. 17th, 170 ma. for 10 minutes each.

There was rather a bad hemorrhage in the end of March.

In August the lady was in town; she was up for a month, and had taken her daughter, a girl of 12 or 13, everywhere—British Museum, Tower, Crystal Palace, etc., etc. She was perfectly well, and the period had recurred regularly every two months, and had lasted three days. One day this lady said that she had only submitted to the treatment by electricity, because, when the treatment failed as she expected it would do, she then thought that she would be operated upon.

February 29th, 1888.—"I have had such a good time this month. Been ill only three days, and had only one day very bad, and a very happy woman is writing to you. I am feeling very well and strong, and so hopeful."

December 11th, 1888.—"I am sure that you will be glad to hear that I am in the best of health. I have never been a day in bed since you saw me there yourself, just before you left for London. I am only two days bad now, and so little in quantity that I require to take no rest, and move about all the time. What a change to what used to be, and how delightful it is! I never in my most sanguine moments thought I would be so well."

June 10th, 1889.—"I am very thankful to tell you that I am keeping well and strong. From August last till February I was just one day 'poorly' regularly every month, and was awfully well. But since then I have had no period at all. I can do any amount of walking, etc."

Case X.—Single, age 37, was sent by Dr. Underhill, and was treated at the Woman's Dispensary, Edinburgh.

Patient has not been strong for a number of years, and has lost a great deal of blood at her periods for a long time. The bleeding now usually lasts two weeks out of every four. About the beginning of the year she noticed that there was a lump in her abdomen; but was not sent to Dr. Underhill on

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account of that, but because she was complaining much more than usual of pain and discomfort across the lower part of the abdomen and down the legs. Dr. Underhill had seen the rapid improvement in health which had come to Case V. after even a few applications of electricity, and considered that this would be a satisfactory test case on account of the hemorrhage, pain, and increasing debility.

On examination, a hard, smooth tumor, situated centrally in the abdomen, was felt extending to within 2 inches of the umbilicus. The cervix was situated very far back and low down in the pelvis, and it was with some difficulty that the sound passed to a depth of 3 inches.

As this was one of the early cases, few applications were made, and even these few were not very strong, the exact strength being a little doubtful.

July 22d, 26th, and 29th, 1887, 50 ma. for 5 minutes. There is already less pain, and the patient feels stronger. The tumor has begun to decrease in size.

August 16th, 50 ma. for 5 minutes. She feels decidedly better; there is less pain, little discomfort, and there is a marked diminution in the size of the growth, more especially at the sides. There has been a very easy period, lasting seven days, during which there was much less discharge than usual. 20th, 50 ma. for 5 minutes.

September 5th, 40 ma. for 5 minutes. As there had been another period, accompanied by more loss and pain, the sound was attached to the positive instead of the negative pole, as had been done in the five previous applications. 8th, 40 ma. 13th, 60 ma. 20th, 70 ma. for 5 minutes each.

October 7th, 60 ma. for 5 minutes. The tumor is probably not half the size it was six weeks ago. It extends now to 2 inches above the pubes. 20th, 28th, and 31st, 60 ma. for 5 minutes.

November 4th, 70 ma. for 5 minutes. The tumor can now be felt one inch above the pubes and entirely to the left of the middle line.

February 9th, 1888.—Has been very well. There is not any pain, there is very much less loss at the periods, and on pressing deeply into the abdomen, no vestige of tumor can be felt.

April 6th, called to-day to say that she was quite well.

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CASE XI.—Single, age 26, was sent to the Royal Infirmary, Edinburgh, by Dr. Wilson, of Old Meldrum, in July, 1887.

The patient was a tall, nice-looking girl, but terribly blanched and bloodless. For rather more than two years there had been a great loss of blood at every menstrual period. Now, the flow lasts for ten or twelve days, and is usually accompanied by severe pain. For the last eight months hypodermic injections of ergot have been given once and sometimes twice a week, and relief from pain has had often to be obtained by the use of morphia suppositories.

On first examination, the tumor was found to extend to midway between the pubes and umbilicus, and before the period, it reached up to the umbilicus. The cervix was situated far back; and in front of it and pressing down on the bladder was a mass of tumor. The sound passed 4¼ inches.

July 30th, 1887.—60 ma. for 5 minutes.

August 1st, 80 ma. for 5 minutes. The period, which was over before the first application on 30th July, having lasted twelve days, returned on the 3d August, and the bleeding continued for ten days. 16th, 40 ma. 18th, 60 ma. 20th, 60 ma. 23d, 60 ma. 25th, 60 ma. 27th, 80 ma. for 5 minutes each. The tumor has been becoming steadily smaller, and is now less, the patient says, than when first noticed. 30th, 50 ma. for 5 minutes.

September 1st, 80 ma. for 5 minutes. For two years the patient has not felt so well and strong as she does to-day. She looks immensely better than she did a month ago. 3d, 6th, and 8th, 80 ma. for 5 minutes. On deep pressure the top of the tumor can be felt with difficulty from the abdomen. 10th, 80 ma. for 5 minutes. There was a little red discharge for a few hours yesterday. 13th, 80 ma. 17th, 80 ma. 20th, 70 ma. for 5 minutes each.

With the exception of a slight "show" for a few hours, there had been no hemorrhage from the uterus for nearly six weeks, and the patient was allowed to go home. Shortly after going home she wrote to say that she had had a very severe bleeding. Some time after that she wrote that she was much better; but as she was steadily losing ground, by the beginning of 1888 she was to come back to the hospital for more of the treatment, experience having shown that she had had neither strong enough doses nor enough of them. Our

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removal from Edinburgh prevented further treatment, and about September, 1888, it appears that her ovaries were removed by a gentleman, who at that time advised, strangely enough, treatment by electricity to several patients, who eventually came south for it.

The exact strength of current used was doubtful.

CASE XII.—Married, age 48, came to the Woman's Dispensary, Edinburgh, in June, 1887.

Married for twenty-six years, and the mother of eight children, the youngest being 11 years of age. She does not remember when she first began to be ill, but says that it is a number of years ago. She suffers from constant bearing-down pain, which prevents her walking more than a very short distance at a time, and from general debility, which prevents her attending to her house. She is frequently so used up by 12 o'clock that she has to go to bed for the rest of the day. Menstruation is now very irregular, and occurs every few months.

On passing the finger into the vagina, it was found that the whole of the pelvis was filled by a tumor. The cervix uteri, of large size and deeply lacerated on both sides, was situated behind and close to the pubes, and the sound passed backward with a very much exaggerated curve to a depth of 3¾ inches. Had the cervix not been torn the length of the womb would have been about 5 inches. The fibroid was so large and so firmly fixed in the pelvis, that it could not be raised either by pushing up with the fingers or with the sound. Some little temporary relief was given by raising it slightly by means of glycerin pads.

Treatment by electricity was begun on the 8th August, 1887. The sound attached to the negative pole was passed into the uterine cavity, and a current of about 50 ma. allowed to flow for five minutes. The patient did not know that anything special was being done, and thought it a long examination! The treatment was repeated on the 19th. In the mean time there had been some bleeding; but the woman felt better and lighter, and had eaten her breakfast with more relish than she had done for a long time. Applications were made on the 28th, on the 9th and 23d September, and on the 14th, 21st, 24th, and 31st October—the direction of the current being reversed in the last five. After the second there was

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decided diminution in size of the tumor. After the sixth, I was able to raise the mass out of the pelvis into the abdomen with the sound, though it dropped back again as soon as the instrument was removed. Nothing was seen of this patient until the 20th January, 1888. In the interval she had, in addition to doing her housework, nursed her daughter through a bad attack of double pneumonia following rheumatic fever, which had left the heart in a shaky condition.

January 20th, 65 ma. 27th, 155 ma. for 5 minutes each.

To-day the uterus was found to have left its position of retroversion. It now extended from 3 inches above the pubes to the vaginal outlet. The treatment consisted in eleven applications—four negative and seven positive. The primary result was that she became such a busy woman that she did not have time to come for more treatment, as I wished.

In September she was very well.

January 19th, 1889.—Almost one year from the date of the last application she was in perfect health, except for a slight occasional feeling of weakness across the stomach; able to do all her work, and to walk as far as she ever wished to walk. She has still periods occasionally as before.

CASE XIII.—Married, age 47; was sent by Dr. Ross, of Belfast.

For three years this lady has been an invalid. She cannot move, even while in bed, without setting up great pain in the pelvis. She can scarcely walk, and she finds that standing is worse than anything else. Menorrhagia is also a prominent symptom.

Examination is difficult, on account of great tenderness, but the pelvis is found to be almost filled with tumor, or tumor combined with surrounding cellular swelling. The sound passes backward for between 3 and 4 inches.

The treatment was carried out before we had Gaiffe's galvanometer.

August 13th and 15th, 1887, 40 ma. for 5 minutes. Was very tired after the first application; but thinks that she already feels a little better. 17th, 40 ma. 19th, 50 ma. for 5 minutes each. Says that she is decidedly better to-day. 22d and 24th, 50 ma. for 5 minutes.

September 3d, 40 ma. for 5 minutes. There has been rather less flow than usual, and there has been a vast improvement

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in comfort, comparatively little pain, and freedom to walk about a little. 5th, 40 ma. for 5 minutes. Walked fully half a mile to-day. 7th, 40 ma. for 5 minutes. To-day she does not feel so well. 9th, 40 ma. 12th, 50 ma. 14th, 50 ma. for 5 minutes each. Says that she feels "tip-top," and is in such spirits that she had to be strongly warned to be careful. 29th, 80 ma. for 5 minutes. There has been less discharge, though the lady has been walking about every day. She can stand now with perfect comfort, and without bringing on pain.

October 1st, 85 ma. 3d, 70 ma. for 5 minutes each. The sound was always made positive. Is now quite well, and walked a mile. The cavity measured 2½ inches. 7th.—"I left Edinburgh on Tuesday, and arrived at Stranraer, Wednesday. I was up before six to catch the boat, took two of the cocaine lozenges, which were of such use to me. I was not ill. My 'period' came on that morning, so I felt most thankful I got on so well. I arrived here (Belfast) at half-past eight last evening, and feel wonderfully well to-day. Dr. Ross was much pleased with my looks and progress. Your treatment has been of great use to me."

February 13th, 1888.—"I feel so much better than I did last winter."

Dr. Ross wrote on the 10th June, 1889: "I made a vaginal examination, and the change for the better in and around the uterus is remarkable; in fact, I could find nothing amiss except an elongated cervix. The abdominal swelling has also greatly subsided, and with this improvement in the physical signs, the general is as great. Severe hemorrhage ceased, and she can now walk about. Both she and I consider truly that her case is a triumph for electricity."

Case XIV.—Married, age 36, was admitted into the special ward for the treatment of abdominal tumors in the Royal Infirmary, Edinburgh, in August, 1887.

The patient was the mother of five children, the youngest of whom was fifteen months old. These had all been born without aid, after tedious labors. Of three sisters one has suffered from profuse discharge every month, and was becoming so much run down that she was advised by Mrs. —— to come home for the same treatment which she herself had undergone. As this meant a journey from China, it shows very clearly how much benefit this patient had derived from

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her treatment by electricity. However, the change of air to Formosa did wonders, and there is at present no necessity to come further.

Mrs. —— had enjoyed good health until about the beginning of the year. In February she was admitted into one of the medical wards of the Royal Infirmary on account of an attack of inflammation (?). While there the tumor was discovered; it was said to have been pronounced to be cystic, and operation was strongly advised. After a residence of five or six weeks she went home, and while there was visited by the house physician, who had been sent to try and persuade her to allow the tumor to be removed. This was, however, declined. When she was admitted under our care she complained of abdominal pain, of a feeling of dragging from the back, of difficulty in walking, and of being easily fatigued. There is also very great pain every month. There was no increase in menstruation, but the tumor had been noticed to swell up before the flow came on.

On examining the abdomen, the tumor was found to be situated rather more on the right than the left side, it reached to midway between the pubes and the umbilicus, and it could be moved a little in any direction. But there could be no doubt but that it was an ordinary fibroid tumor of the uterus. The cervix was in the usual situation, and the sound entered fully 3¼ inches.

The treatment consisted in thirteen negative applications, the strength of the currents recorded being not absolutely correct.

August 16th, 40 ma. 18th, 60 ma. 20th, 60 ma. for 5 minutes each. She now walks much better and feels stronger in every way. 30th, 80 ma. for 5 minutes.

September 1st, 60 ma. for 5 minutes. Was very tired after the last sitting, and complains of frontal headache. 3d, 10th, and 13th, 60 ma. for 5 minutes. The headache gave way to a few doses of iodide of potassium, and the patient thinks that she is nearly well. 17th, 50 ma. 20th, 60 ma. 22d, 60 ma. 24th, 60 ma. 27th, 50 ma. for 5 minutes each. She feels quite well, and the treatment will now be stopped. Indeed, it has been difficult to persuade her to come as often as she has.

February 26th, 1888.—Is in perfect health, and the tumor feels to the patient to be the size of a small egg.

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September, 1888.—The general health continues to be good, but she is easily fatigued, and sometimes thinks that the tumor is larger.

January 19th, 1889.—Sixteen months after the cessation of the treatment she says, "I am as well as I have any desire to be." She can walk well and without undue fatigue; there is not any dysmenorrhœa; no pain in the abdomen, and the dragging from the back is a thing of the past.

Case XV.—Married, age 34, was sent by Dr. Wemyss, of Broughty-Ferry.

This patient had been married for a number of years, and had enjoyed good health until the early part of 1885. The commencement of her illness is somewhat unusual. Without there being anything to cause or account for it, the lady vomited a large quantity of blood. This occurred at the time of the period, and appeared to have replaced it, as the usual discharge from the uterus did not come on. From that time there has been more or less pelvic discomfort and pain. There is not any menorrhagia; indeed, there is less blood than there used to be, but it is accompanied by a profuse watery discharge. Dr. Wemyss sent her first in October, 1885. At that time she was advised to wait and do nothing. At her next visit the same advice was given. When she came for the third time, however, the tumor was decidedly larger, and was causing more discomfort. She was advised to have the ovaries removed, and was to come back to have the operation when it was convenient to her. But, when she returned in August, we had given up operating on fibroids. For about a week out of every month the patient is fit for little; something had to be done.

On examination, it was found that the uterus was pushed forward by a mass filling the hollow of the sacrum. The sound passed forward to a depth of 4¼ inches, and the uterus could be moved almost independently of the mass of tumor.

The treatment consisted in sixteen applications of electricity, the clay pad being made positive and the sound or puncturing needle negative.

August 22d, 1887, 40 ma. 24th, 40 ma. 26th, 50 ma. 29th, 70 ma. for 5 minutes each.

September 3d, 60 ma. for 5 minutes. The mass was punctured to-day, and the passage of the electrical current gave

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rise to less discomfort. There has been a period, which caused much less pain and disturbance, and was accompanied by less watery discharge. 6th and 8th, 40 ma. for 5 minutes. 10th, 60 ma. for 7 minutes. There is a marked improvement; the lady walks better, and finds her left leg, which has been a source of trouble to her for a long time, much more comfortable and less painful. 13th, 40 ma. for 7 minutes. A puncture was made to-day for the second time. The patient says that she feels almost quite well. 15th, 40 ma. for 5 minutes. The mass, which was previously as large as the fist, feels now not half the size. 17th, 50 ma. 20th, 60 ma. for 5 minutes each. 22d, 70 ma. for 7 minutes. 24th, 27th, and 29th, 50 ma. for 7 minutes. Says that she is perfectly well. The uterine cavity is one inch shorter than it was.

Dr. Wemyss wrote on 21st October, 1888: "Mrs. —— keeps very well. She is in excellent health, and the tumor feels very much the same in size. The sound can only be inserted about 3 inches."

Case XVI.—Married, age 37; from Dr. Wilson, Johnston, Renfrewshire; consulted Dr. Keith in August, 1887.

At the age of 23 she was married, and enjoyed good health for twelve years. Two years ago she began to lose too much blood every month, and a year after, a tumor was discovered on examination, which was made after a severe flooding. Since that time she says she has flooded nearly every month, and that the tumor has increased very markedly in size. Before each menstrual period it had been noted that the tumor became considerably swelled. Of late she has become breathless and unable to do much.

The patient, a big, soft, flabby woman, is very bloodless. On examining the abdomen a tumor could be both seen and felt, occupying the right side of the abdomen, crossing the middle line to the left and filling half that side. Its upper margin was level with the umbilicus. There was some very considerable difficulty in passing the sound on account of the irregularity of the cavity, which measured 4½ inches in depth. The diagnosis was, of course, evident.

This was a case for the application of the positive pole to the interior of the uterus, and the treatment was begun on

August 22d and 25th, 1887, 40 ma. for 5 minutes. She was

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very tired in the afternoon after the first application. 27th, 40 ma. for 5 minutes. She feels better than she has done for the past eighteen months, and there is a decided decrease in the size of the tumor. 30th, 40 ma. for 5 minutes.

September 1st, 40 ma. for 5 minutes. Feels very well, except for a frontal headache, which was, however, quickly relieved by iodide of potassium. 3d, 5th, and 17th, 40 ma. for 5 minutes. The period is over. The loss has been very much less than usual, though still much more than it ought to be. The patient feels better than usual, and the tumor swelled up but little. 20th, 40 ma. 22d, 80 ma. 24th, 60 ma. for 5 minutes each. 28th, 120 ma. for 7½ minutes.

October 1st, 60 ma. for 5 minutes. The tumor reached to barely 2 inches above the pubes on the right side. There is now nothing to be felt on the left. The cavity measures 2¾ inches. In the general health there is a marked improvement, and the patient says that she now feels as well as she was before she first began to be ill.

Case XVII.—Married, age 30; was sent to the Edinburgh Royal Infirmary by Dr. Whiteford, of Greenock.

The history of this patient was as follows:—She had been married for ten years, and had known of the presence of a lump in her abdomen for five years. As this did not give rise to any inconvenience, the woman never thought of consulting a doctor until she began to be ill. The form the illness took was simply that she became unable to do anything for debility, due to excessive loss of blood at every menstrual period. She now bleeds for from ten to fourteen days at a time, and then has an interval of two or three weeks. This has been going on for the last two or three years.

She is seen to be ghostly white, her face, lips, and eyelids are absolutely colorless, and she can scarcely get about from weakness; even to cross a room requires a great effort on her part. A year ago she was a patient in the Greenock Infirmary for three months. She had a great deal of medicine while there, and says that she was told that she could not live long, and that nothing more than had been done could be tried in her case. Dr. Whiteford give her ergot, and this drug was the only one she had had which checked the hemorrhage in the slightest degree.

On examining the abdomen a hard, smooth, very promi-

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nent tumor, extending to one inch above the umbilicus, and entirely filling the abdomen up to that level, was felt. The cervix was very far back, and the sound passed 5 inches into the cavity of the womb.

The woman was very poor, and for a long time her food had consisted mostly of bread and tea, and even when there was anything better in the house, she did not feel able for the exertion of cooking it. Bread and tea cannot be a very good blood-making diet, yet it is wonderful how she managed to have so much blood to lose and yet be alive.

The exact strength of the current passed through the tumor is doubtful in the first six and twenty applications. As the period came on the day after she came into hospital, and lasted for fourteen days, the treatment was not begun until August 25th, 1887, 60 ma. for 5 minutes. 27th, 80 ma. for 9 minutes. Was very tired after the first application. 30th, 80 ma. for 7 minutes. She is surprised to find that she can walk more easily.

September 1st, 80 ma. for 5 minutes. The tumor is decidedly smaller. Patient has begun to take Blaud's pills. 3d, 6th, 8th, and 10th, 80 ma. for 5 minutes. Can now walk two miles with ease, and says that she has not been so well nor has walked so far for the last two and a half years. 13th, 80 ma. for 5 minutes. Yesterday the tumor had swelled considerably, but is smaller again to-day. 15th, 100 ma. 17th, 90 ma. for 5 minutes each. To-day she remarked that she would be quite happy if she kept as well as she now is. 20th, 120 ma. 29th, 105 ma. for 5 minutes each. The first period since the commencement of the treatment is over; it lasted five days instead of, at least, ten, and although the flow of blood was pretty brisk while it did last, she does not feel much pulled down, and has immensely more color than when she first came to Edinburgh.

October 1st, 120 ma. for 5 minutes. Until now the positive has been the internal electrode. At the next seven the negative was used inside the cavity. 4th, 100 ma. 6th, 120 ma. 8th, 120 ma. for 5 minutes each. Yesterday the patient went to Leith and walked along the pier. She was out the whole of the afternoon, and must have walked at least five miles. 11th, 13th, 15th, and 27th, 120 ma. for 5 minutes. The second period is over; the quantity of blood lost has been much the same as

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the last time. As there was a slight return of the flow of blood from the uterus after the last sitting, the direction of the current was again changed in the following ten applications. 29th, 120 ma. for 5 minutes.

November 1st, 3d, 5th, and 8th, 120 ma. for 5 minutes. The patient went to the Convalescent Home at Costorphine. While there the flow came on; it lasted for six days, and was immensely less than it had been for a very long time, yet the people at the Home were quite alarmed at the amount.

December 1st, 135 ma. for 5 minutes. 2d, 240 ma. for 8 minutes. 6th, 200 ma. for 10 minutes. 8th, 190 ma. for 10 minutes. 10th, 205 ma. for 10 minutes. The tumor is now one-third less in size than it was, and instead of being smooth has become irregular in outline. There has been a large deposit of fat on the abdominal wall. The period came on after this application, and the amount of blood lost was fully more than at the last three, yet the woman does not feel at all the worse for it. 24th, 230 ma. 26th, 240 ma. 28th, 240 ma. 30th, 235 ma. for 10 minutes each.

January 3d, 1888, 230 ma. for 10 minutes. The treatment consisted in thirty-six applications—twenty-four positive and twelve negative—and the patient left hospital a well woman.

There are several points of interest about this case. It cannot be said that the comfort and rest of the hospital had anything to do with her recovery, as she had had the same comfort and rest while in the Greenock Hospital. It would also be expected that a change from the low diet of tea and bread to the ordinary hospital fare would have resulted in an increased flow of blood, more especially as the improved diet was accompanied, almost from the beginning, by the administration of a regular course of iron pills. The woman was also sensible enough not to be distressed by the presence of a tumor which did not give rise to any symptoms; and again to consider herself cured when her tumor had, after having been an active agent for evil, become quieted down and had ceased to give rise to symptoms.

In March Dr. Whiteford reported that the patient was very well.

Dr. Whiteford kindly sent the following report on 13th March, 1889: Monthly period now lasts six or seven days, as compared with four or five immediately after treatment and

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for six months thereafter. Still does not lose, withal, so much as formerly, but has more pain (pelvic) now at the time. The quantity lost during any one day has been gradually lessening during the last four or five months, but lasts two days longer. The tumor has increased in size toward the left side (this is her own opinion, and from my recollection I think this is probably true). Slight anæmic murmur in right jugular, but lips rosy in color, and looks fairly well.

CASE XVIII.—Married, age 46; had been fragile and delicate for a number of years. She thinks that she has at all times lost more blood at the monthly periods than she could afford, and in the interval there is a constant leucorrhœal discharge. In addition to this she suffers from severe pelvic pains. Treatment has never done her more than very temporary good. The interior of the womb was curetted on three occasions, and was followed by some improvement for a time.

The uterine cavity measured four inches. Eleven applications of electricity were made in 1887, the internal electrode being positive. Seven additional applications were made in 1888.

August 26th, 1887, 70 ma. for 5 minutes.

September 2d, 40 ma. for 5 minutes. The first sitting was followed by a very considerable increase in the amount of pain, and it also brought on bleeding, which has lasted until to-day. 5th, 40 ma. for 5 minutes. There has been less pain during the last two days. 8th, 60 ma. for 5 minutes. To-day the patient does not feel so well; but the passage of the electrical current did not give rise to as much pain as it has done before. 14th, 40 ma. for 5 minutes. The amount of pain which there has been during this menstrual flow has been the same as usual, but the quantity of hemorrhage was not greater during the whole time than it often has been in a single day. 16th, 19th, and 21st, 40 ma. for 5 minutes. Is now feeling better, and says that her nerves are stronger, and does not now start when a door bangs or such like. 23d, 40 ma. 28th, 120 ma. for 5 minutes each.

October 5th, 120 ma. for 5 minutes. Feels so much better that she thinks that she can stop all treatment.

March 23d, 1888.—Until a few weeks ago the lady felt very well; but hearing that we were leaving Edinburgh, she was very anxious to have a few more applications, as she says that

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she feels that this is the only treatment which has really ever done her any good. 25th, 120 ma. 26th, 180 ma. 27th, 145 ma. 28th, 150 ma. 30th, 120 ma. 31st, 115 ma. for 7 minutes each.

April 2d, 120 ma. for 7 minutes. Gaiffe's galvanometer was used to measure the strength of the current at this time. Owing to necessity, the treatment, consisting of seven applications, was made in eight days; the strength of the current was greater, and the length of time of each application longer, and, just at first, was a little too much for the patient. However, she quickly got over the bad effect, and kept well until January, 1889. She came up town in the following April. She was certainly better than she was two years ago, but had a very severe backache when she did much. 19th, 100 ma. for 5 minutes. 22d, 80 ma. for 10 minutes. 24th, 60 ma. for 9 minutes. 26th, 70 ma. for 10 minutes. 29th, 90 ma. for 10 minutes.

May 1st, 100 ma. 3d, 80 ma. 6th, 90 ma. 15th, 70 ma. 17th, 60 ma. 20th, 60 ma. 22d, 60 ma. for 10 minutes each. Is feeling very much better. 27th, 60 ma. for 12 minutes. 29th, 60 ma. for 9 minutes. 31st, 60 ma. for 10 minutes.

June 6th, 60 ma. 7th, 60 ma. 10th, 60 ma. 12th, 75 ma. 14th, 100 ma. for 10 minutes each. Is very much better. The tumor is very decidedly smaller.

CASE XIX.—Married, age 57; was brought by Dr. M'Gibbon in August, 1887.

Dr. M'Gibbon had watched the growth of the tumor in this case for many years, and thirteen years before Dr. Keith had seen the lady with him. At that time she was 44 years of age, and had ceased to menstruate ten years before. It is doubtful how long ago it is since the tumor was first noticed, but in 1874 it extended up to the level of the umbilicus. At that date there was little discomfort, and as the tumor was growing very slowly, the patient was advised to wait and see what time would do for her. Year by year the mass steadily increased in size, and as time went on there began to be decided discomfort from its presence, and lately the general health has begun to be seriously affected, and the lady feels that if nothing be done she cannot live long. She is now never free from pain in the right side of the tumor, there is a constant feeling of weight and discomfort, and she has no rest

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with her bladder, the desire to pass water being present night and day.

For thirteen years the tumor has grown from the level of the umbilicus until its upper part is hidden by the ribs. The pelvis was entirely filled by the mass, and the cervix was represented by a simple depression, into which a sound passed to a depth of 1¾ inches. The bladder was situated between the tumor and the anterior vaginal wall. As one part of the tumor was slightly softer than the rest, an aspirator needle was inserted, but no fluid was obtained for microscopical examination. The diagnosis of fibroid growth was thus confirmed, and it was determined to treat the tumor by electricity. In a case such as this, where there was no hemorrhage, and where the object was to lessen the size of the growth, the negative pole was connected to the internal electrode, passed into the uterine cavity, as, on account of the relation of the bladder, puncture could not be made. This was done in all of the twenty-three applications, the strength of current being not exact.

August 26th, 1887, 60 ma. 29th, 40 ma. 31st, 40 ma. for 5 minutes each. There was considerable pain after the first application five days ago, but already the patient feels better in every way, and there is a very decided diminution in the size of the tumor.

September 2d and 5th, 40 ma. for 5 minutes. The old lady thinks that she has taken a new lease of life, and said to-day that she felt as if she could not have gone on much longer without relief. 7th, 40 ma. 9th, 40 ma. 13th, 50 ma. for 5 minutes each. Until to-day it has been noticed that the tumor became smaller after every application. To-day, however, it is considerably swelled. 15th, 60 ma. for 5 minutes. The swelling of two days ago is gone. 17th, 60 ma. for 5 minutes. She says that she would be quite content with the present improvement; she does not have much pain, and can have a comfortable night's rest, as the irritability of the bladder is almost quite gone. 20th, 80 ma. 22d, 80 ma. 24th, 40 ma. 27th, 60 ma. for 5 minutes each. Is in the best of spirits to-day, and says that she feels very well indeed. 29th, 90 ma. for 5 minutes.

October 4th, 80 ma. 6th, 70 ma. 8th, 80 ma. for 5 minutes each. Feels very well, and the tumor is rapidly decreasing

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in size. 11th, 80 ma. 13th, 120 ma. 15th, 90 ma. 18th, 50 ma. 20th, 80 ma. for 5 minutes each.

In every way the old lady feels better, she does not have any difficulty with her bladder, she has not any pain, and she can walk with ease. The tumor is not half as large as it was in August, two months ago, and is freely movable. In the beginning of April, 1888, Dr. M'Gibbon informed us that he heard that the tumor was rapidly decreasing in size. Some time afterward we heard that the old lady had died while away from home. Dr. M'Gibbon did not know what was the cause of death, but had heard that there had been a swelling of the tumor some time before, though this had subsided before her last illness.

CASE XX.—Married, age 46; came to the Woman's Dispensary, Edinburgh, on the 29th August, 1887.

Patient, who is a widow, has been a martyr to asthma all her life. Twelve years ago she first observed a swelling in the abdomen about the size of an egg. It has been slowly but steadily increasing in size, and although it is by no means very large, it appears to cause more trouble to the organs inside the chest than one would expect in any but an asthmatic or bronchitic subject. She complained also of dysmenorrhœa.

Examination of the abdomen revealed a hard irregular tumor, extending to rather more than one inch above the umbilicus. It was markedly prominent, and was larger than the description would lead one to expect. The tumor was found to fill the pelvis, reaching to nearly the vaginal outlet. The cervix was shortened, and situated immediately behind the pubes. The cavity measured 5½ inches.

Treatment.—A puncture was made into the centre of the pelvic mass on the 29th of the month, and a current of about 40 ma. was allowed to flow for two and a half minutes. The application was borne very badly, and could not be continued for the usual length of time. After this first puncture, it was not thought necessary or advisable to repeat this method; so the sound was passed into the cavity and directed backward as much as possible. After the second application on the 5th September, the patient was confined to the house by an attack of bronchitis, and did not return for treatment until the 21st October. The current was passed on that day, and again on

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the 24th, 28th, 31st, and then on the 4th, 14th, 18th, and 21st November. The strength varied from about 40 to 80 ma. She now felt much better in her general health, and was freer from attacks of asthma than she had been for a long time.

November 24th, 70 ma. 28th, 45 ma. for 5 minutes each.

December 2d, 75 ma. 9th, 60 ma. 11th, 85 ma. 14th, 100 ma. 17th, 115 ma. 20th, 125 ma. 23d, 135 ma. 30th, 170 ma. for 5 minutes each.

February 3d, 100 ma. for 5 minutes.

March 2d, 100 ma. 5th, 90 ma. for 5 minutes each. The tumor has been steadily decreasing in size, and is now not more than half as big as it was five months ago. 7th, 100 ma. 9th, 70 ma. 19th, 100 ma. 21st, 110 ma. 23d, 140 ma. 26th, 130 ma. 28th, 120 ma. 30th, 130 ma. for 5 minutes each. To-day the patient said, "It has made a new creature of me."

April 2d, 120 ma. 4th, 135 ma. 6th, 135 ma. for 5 minutes each.

In all, thirty-four sittings, at each of which the electrical current was passed from the clay pad on the abdomen to the negative electrode in the uterus.

The tumor is very much smaller probably about one-third of its original size.

In September the tumor was said to be still decreasing in size; there was less pain at the periods, and these lasted two instead of seven days; and, strangely enough, there had been no asthma.

Case XXI.—Unmarried, aged 46. This patient has had a large fibrous tumor for many years—at least twelve—and has often been urgent for its removal by operation. Her request was not acceded to, for her general health was always good, and she has been able to maintain herself by keeping a small lodging-house. Menstruation has entirely ceased for three years. The tumor is hard, and the circumference of the abdomen is 40 inches. She has some difficulty in moving about from its weight, and complains of pain in the back.

She had no faith in the proposed treatment, but submitted to it in the hope that the backache might be relieved.

Three applications of about 40 ma. were made on the 1st, 6th, and 16th September, 1887.

At first the patient thought that she was better, and then came to the conclusion that the back pain was worse. She

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did not return for treatment. Hearing that she was not well, she was visited at her home, and was found washing down the common stair. Her circumstances prevented her taking rest.

Some months afterward we heard that she had had a severe flooding, and had to be plugged before the bleeding was checked. This was after an interval of nearly four years' absence of menstruation. There has been no return, and she is now able to look after her house, though the tumor is said to have increased.

CASE XXII.—Married, age 60; was admitted into the Royal Infirmary, Edinburgh, in August, 1887.

The patient, a broken-down looking woman, thinks that she first noticed the tumor twelve or fifteen years ago. Menstruation ceased at the age of 51, but recommenced at 59 with fair regularity, and the loss is now great. Six months ago, she says that the tumor did not reach above the navel; now it entirely fills the abdomen, and passes well up underneath the ribs. It is slightly movable. The cavity is large and irregular, and a sound passes many inches into it. The os uteri admits the tip of the finger. On several occasions attempts were made to find out if there were any polypi, and in October a small one was removed. The size and irregular shape of the cavity may have prevented the removal of others.

Gaiffe's galvanometer was not obtained until the treatment was almost finished, so that the figures are not quite correct.

September 1st, 3d, 6th, and 8th, 40 ma. for 5 minutes. 10th, 35 ma. for 5 minutes. The tumor is swollen and painful. 13th, 40 ma. 17th, 40 ma. 20th, 60 ma. for 5 minutes each. The tumor has begun to diminish in size. 22d, 60 ma. 24th, 85 ma. 27th, 120 ma. for 5 minutes each. The patient says that she can walk better. 29th, 75 ma. for 5 minutes.

October 1st, 95 ma. 4th, 120 ma. 6th, 120 ma. for 5 minutes each. A small vascular polypus was removed with forceps from the cavity. 11th, 13th, 15th, 18th, 22d, 25th, 27th, and 29th, 120 ma. for 5 minutes.

November 1st, 120 ma. for 5 minutes. Bleeding, which has been almost continuous for the last two months, is now nearly stopped, and the patient says that she feels very well. Till now the sound has been positive, but as the bleeding was checked it was made negative. 3d, 5th, 8th, 10th, 15th, 17th,

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19th, 22d, and 24th, 120 ma. for 5 minutes. 26th, 160 ma. for 5 minutes. Gaiffe's galvanometer was in use to-day. 29th, 150 ma. for 5 minutes. Since last application there has been a slight bloody discharge, due possibly to a sudden breaking of the current. The sound was made positive.

December 1st, 145 ma. for 5 minutes. The bleeding has stopped. 3d, 180 ma. 6th, 225 ma. 8th, 240 ma. for 5 minutes each. Goes home to-morrow feeling well, and with the tumor smaller in every direction.

Dr. Sinclair wrote on the 11th June, 1889: "The tumor enlarged very much after leaving Edinburgh, then diminished again a little, though still large in size, and at present is large and tender to touch. The bleeding has stopped for some time. Mrs. —— is at present very unwell, and I am not certain whether she will recover or not; there seems to be localized peritonitis and she also suffers from bronchial symptoms."

CASE XXIII.—Single, age 50; sent by Dr. M'Kercher, Dalbeattie, in September, 1887.

This lady had been an invalid for a number of years, and as far as she can remember the tumor was first noticed about 20 years ago. The prominent symptom which the new growth has given rise to has been pain. There have not been occasional attacks of pain, but she says that she has not been without it for many years, and she does not remember when she last had a comfortable night's rest. This constant pain has slowly but steadily undermined her general health, and she has now for the last few years passed the whole of the winter in bed, being able to go about for only four months in the summer. There has, at no time, been any disturbance in the menstrual functions.

In September, 1887, the appearance of this lady was lamentable. She looked ill and miserable. She could not walk without support, and had to be assisted into the house.

On examination of the abdomen a large tumor was seen, which on account of the breadth of the pelvic bones was of much greater size than the description would lead one to suppose. The growth was very tender, and it was not possible to examine it except with the greatest gentleness. It was found to be of a very irregular shape, and to be composed of three main portions. The largest part was situated in the left side, and caused that side to bulge considerably, giving somewhat

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the appearance of a tumor of the kidney. Between this mass and the umbilicus the tumor extended to two inches above the level of the navel, and on the right side it reached as high as that landmark. The uterine cavity measured four inches.

The treatment by electricity lasted for eight weeks, and during that time twenty-three negative applications were made, though unfortunately the exact strength of the current used is not known.

September 2d and 5th, 1887, 40 ma. for 5 minutes. The patient states to-day that she thinks that there is less pain. 7th and 9th, 40 ma. for 5 minutes. Is decidedly better, and the tumor can now be handled quite freely without causing pain. 12th and 16th, 50 ma. for 5 minutes. There has been a discharge of blood from the uterus for some days. 19th, 50 ma. 21st, 60 ma. for 5 minutes each. The improvement continues, and the tumor is rapidly decreasing in size. 23d, 80 ma. for 5 minutes. 26th, 60 ma. for 7½ minutes. The patient said to-day that she had been feeling so ill before she left home, that she thinks she would have been dead by now, had she not come to Edinburgh. 28th and 30th, 60 ma. for 5 minutes.

October 3d, 55 ma. 5th, 80 ma. 7th, 80 ma. for 5 minutes each. The mass of tumor on the left side does not now extend outward beyond a line drawn up from the anterior superior iliac spine, and the growth is at least a third smaller than it was at the beginning of last month. Yesterday the lady walked fully two miles and did not feel fatigued. 10th, 80 ma. 12th, 80 ma. 14th, 60 ma. 17th, 50 ma. 19th, 55 ma. for 5 minutes each. The tumor continues to decrease in size. 21st, 70 ma. for 5 minutes. 24th, 80 ma. for 5 minutes. 26th, 80 ma. for 7½ minutes. The patient is a new woman, and has the appearance of being in good health and spirits; she walks well, sleeps better, and has improved in every way. That part of the tumor which was situated in the loin is now between the umbilicus and ilium; and the part on the right side extends to barely a couple of inches above the pelvic brim, instead of being as high as the navel. The tumor is not as large as it was two months ago by fully one-half.

Extract from letter dated 29th June, 1889: "I think my general health has much improved. I was able to keep up all last winter. I think that the swellings have not increased.

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I am still troubled with inaction and catarrh of the bowels, but I am stronger, and no fever now. I don't get so faint and sick as I did."

CASE XXIV.—Single, age 28; was sent by the late Dr. Murray Gibson, of Portobello, to the Woman's Dispensary, Edinburgh, on the 5th of September, 1887.

Eight years before she had been delivered of an illegitimate child after a natural labor. From that time there had been more or less constant pain in the back and in the left side, aggravated at the periods, which were not unduly prolonged. A profuse flow of mucous discharge has pulled her down, and latterly she has had to give up her work.

The cavity of the uterus was found to be enlarged to 3½ inches, and on the left side and attached to the upper part of the womb was a hard, tender mass the size of a hen's egg.

The electrical current was passed from the abdomen to the sound in the cavity of the uterus on the 5th, 9th, 12th, 19th, and 30th September, and on the 10th October, the strength varying from about 40 to 80 ma. After the first sitting she felt a little better. After the third she went back to her work; and as she felt quite well by the end of September, and owing to some difficulty in getting leave for an hour or two to attend the dispensary, she gave up coming, and I have not heard of her since. There was simply a very slight thickening at one side of the uterus when last seen.

CASE XXV.—Single, age 57; was sent to Edinburgh by Dr. Gemmel, of Dunoon, in September, 1887.

This case was one of those rare instances where a fibroid tumor of the uterus continued to grow and to give rise to increased disturbance for years after the menopause. The growth was first noticed at about the age of 49, and a year afterward menstruation ceased and has not returned. For four years before the cessation of the menstrual flow there had been a very considerable increase in the amount of discharge every month, so that it is evident that the tumor had been growing for at least eleven years. Of late there has been decided increase in the severity of the pain, and for the last five weeks the lady had been unable to lie down in bed on account of the discomfort and breathlessness. An extract from Dr. Gemmel's letter gives a very good idea of the precarious condition in which she was: "Six years ago she was seized

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with sudden and severe pain in the left side, and for which she was treated by her Glasgow physician; and on the occasion of my being called, she complained of the same thing, accompanied, however, by some intestinal irritation. She is now back to her frail usual, and if nothing effective can be done, her health and strength will surely fail at no distant date."

The tumor was very large. It caused the right side to bulge greatly, and its upper limit could not be defined, as it extended high up beneath the ribs on both sides.

The treatment consisted of only nineteen applications, and had to be discontinued on account of the illness of the lady's mother. The patient, toward the latter end of the treatment, had to come an hour's journey by rail. Gaiffe's galvanometer was not used. The internal electrode was always made negative.

September 6th, 30 ma. 8th, 40 ma. 27th, 100 ma. for 5 minutes each. Owing to the death of a sister, the treatment had to be discontinued for three weeks. 29th, 105 ma. for 5 minutes.

October 1st, 100 ma. 4th, 120 ma. for 5 minutes each. Feels slightly more comfortable, and the tumor is a little looser. 6th, 105 ma. 8th, 120 ma. 11th, 110 ma. 13th, 120 ma. 21st, 80 ma. for 5 minutes each. The tumor is becoming smaller, and there is now a slight depression between it and the ribs. 24th and 28th, 100 ma. for 5 minutes. Is decidedly better, and can wear her stays for the first time in the last three years. 31st, 80 ma. for 5 minutes.

November 4th, 7th, and 11th, 80 ma. for 5 minutes. The tumor continues to decrease in size, and the patient can now lie in bed all night with comfort. 14th and 17th, 80 ma. for 5 minutes. The patient is very sorry that circumstances render it necessary that she should go home, as she is more comfortable, can eat and sleep well, and is able to walk somewhat better than she did.

Dr. Gemmel writes on 11th June, 1889: "I am very glad to report that Miss —— has benefited greatly by the electrical treatment she received last year for the large uterine fibroid. The swelling very sensibly diminished, the pain almost disappeared, and the severe attacks from which she suffered frequently departed, and life now seems to her worth living for. I have seen Miss —— to-day, and she expresses herself as now

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wonderfully well, and thankful indeed that she placed herself under your care."

CASE XXVI.—Single, age 36; was admitted into the Royal Infirmary in September, 1887.

For the last six years menstruation has been very profuse, and the patient has not been able to do any work for two years. Latterly she has been seldom clear of bleeding for more than a week or ten days at a time, and during the interval there has been a great leucorrhœal discharge. It is not uncommon for the bleeding to continue for three or four weeks. Two years ago the tumor was first noticed, and some time afterward the patient was admitted into Charing Cross Hospital under the care of Dr. Watt Black. Here she remained for several months, and for a time was decidedly better than she had been. For the last year she has been seldom out of bed for more than a few hours at a time.

On admission into the infirmary, the woman was found to be very weak, and able to do little. She had difficulty in geting up-stairs, and a very short walk was all that she could manage. The tumor extended up under the ribs on the right side, and to fully 2 inches above the umbilicus on the left. A sound passed easily to a depth of 6 inches, and then, after some manipulation, nearly 2 inches farther. Gaiffe's galvanometer was not used until the twenty-fifth sitting.

September 6th, 40 ma. for 5 minutes. The passage of the sound started a pretty brisk hemorrhage. 8th, 40 ma. for 5 minutes. There was not so much bleeding to-day when the sound was passed. 13th, 40 ma. 15th, 40 ma. 20th, 80 ma. for 5 minutes each. The period has been going on more or less for the last ten days. There was less discharge than usual. 22d, 80 ma. 24th, 90 ma. 27th, 80 ma. 29th, 70 ma. for 5 minutes each.

October 1st, 95 ma. 4th, 90 ma. for 5 minutes each. The patient is stronger, and can walk better; she managed half a mile to-day. 6th and 15th, 100 ma. for 5 minutes. There has been again an abatement in the quantity of discharge, and, besides, there was an interval of eighteen days. 18th, 100 ma. 20th, 120 ma. 25th, 120 ma. for 5 minutes each.

November 5th, 80 ma. for 5 minutes. There has been some hemorrhage for the last three weeks, but the total loss has not been great. 8th and 10th, 120 ma. for 5 minutes. 15th,

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17th, and 19th, 100 ma. for 5 minutes. 22d, 100 ma. for 8 minutes. Was able to walk fully a mile. 24th, 100 ma. for 8 minutes.

December 3d, 150 ma. for 5 minutes. Gaiffe's galvanometer was used to-day. The period is over; it was bad for two days, and then slight for four. Less discharge than for at least a year, and there was an interval of four weeks. The general health and appearance are much improved. 6th, 275 ma. for 8 minutes. 8th, 285 ma. for 7 minutes. 10th, 190 ma. for 7 minutes. 13th, 300 ma. for 10 minutes. 15th, 210 ma. for 10 minutes. 17th, 285 ma. for 5 minutes. 20th, 210 ma. for 10 minutes. 28th, 200 ma. for 10 minutes. A moderately easy period has been passed, and the patient feels well and strong. 30th, 200 ma. for 10 minutes.

January 5th, 1888.—175 ma. for 10 minutes. 7th, 175 ma. for 10 minutes. 12th, 290 ma. for 8 minutes. 19th, 260 ma. for 8 minutes. The period has lasted five days, and the loss was not very great. 21st, 235 ma. 24th, 250 ma. 26th, 210 ma. 28th, 223 ma. 31st, 215 ma. for 10 minutes each.

February 2d, 175 ma. 4th, 180 ma. 7th, 240 ma. 9th, 215 ma. 11th, 210 ma. 21st, 195 ma. for 10 minutes each. There was less flow than for fully two years, and there was not any diminution in color noticeable. 23d, 200 ma. 28th, 175 ma. for 10 minutes each.

The sound was made positive in forty-six out of the whole number of applications.

The tumor is very much smaller, and no one would recognize the patient of five months ago.

It was suspected at one time that there was a polypus inside the cavity, and the cervix was dilated; but, on account of the very irregular shape of the uterine cavity, nothing could be felt, and forceps could not be passed up to the fundus.

August 30th.—Heard that the woman was very well, that the periods recur at intervals of five weeks, and that the quantity of blood is not great, and that it continues to diminish in amount.

Extract from letter, dated 13th March, 1889: "I was so well then (during a sister's illness); but this last two months I have been so ill with pain and a relaxed state of the bowels like slimy diarrhœa; also a discharge of a greenish color; some call it whites. The monthly periods are not so bad—two days

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pretty bad, and two days not. I can manage with only keeping in bed one day now, and it never lasts longer than five days. The tumor keeps below the right ribs, as it was when I left Edinburgh; but I am sorry it grows higher in front toward the breast bone. I think myself that the treatment is still going on, and that the periods will get better as time goes on. The periods are also now regular once a month, which they were not before the treatment. Came any time before."

CASE XXVII.—Single, age 35; was brought by Dr. Wm. Bruce in September, 1887.

For nearly two years this patient's general health had been becoming rapidly deteriorated by excessive losses of blood at the monthly periods. Instead of lasting three days, as was natural to her, the flow continued for ten or twelve days. About the beginning of the year it was noticed that there was a growth in the abdomen, which was diagnosed by Dr. Bruce to be a fibroid tumor of the uterus, and confirmed later on by Dr. Keith. Removal of the ovaries was recommended. In June the menstrual flow ceased; but, instead of improvement, there was even a more rapid loss of health and strength, as this was accompanied by great irritability of the stomach. In July and August the lady was taken to the seaside, and improved slightly in strength; for, instead of being unable to walk at all, she could manage 100 yards or so with difficulty.

In September she looked very ill and miserable; she was thin, the face was of a greenish shade, and the lips and eyelids were not even tinged with color. The dyspeptic symptoms gave great trouble; medicines and care with diet having no result.

On examination it was found that the tumor reached upward fully as high as the umbilicus. It filled the whole of the pelvis extending to within an inch of the outside; there was almost no vagina, and the cervix was drawn up in front out of reach of the finger, but could be felt through the thin abdominal wall. Two large arteries were felt running across from one side of the pelvis to the other.

As it was not possible to reach the cervix, the point of a needle had to be thrust into the tumor on every one of the eighteen applications which were made. The needle was connected to the negative pole of the battery. It is unfortu-

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nate that the galvanometer, which was used, was not very correct, and the figures must be taken as being only somewhat nearly correct.

September 11th, 40 ma. 13th, 40 ma. 15th, 60 ma. for 5 minutes each. The tumor is to-day certainly smaller. 17th, 50 ma. for 5 minutes. There is a decided diminution in size even since the day before yesterday. 20th, 80 ma. 22d, 45 ma. for 5 minutes each. To-day the patient feels better; can walk more easily, and has not been so sick. The tumor continues to diminish. 24th, 40 ma. for 5 minutes. It was observed to-day that pulsation had ceased in the two arteries, which have been described as running across the upper part of the vagina. No puncture was ever made within ¾ of an inch of these vessels. 27th and 29th, 70 ma. for 5 minutes. The patient begins to have a much better color.

October 1st, 105 ma. 4th, 90 ma. 6th, 80 ma. 8th, 80 ma. for 5 minutes each. Yesterday the patient sailed round the Channel Fleet, which was lying at Queensferry. For at least a year, it would never have occurred either to her or to her friends that she could attempt such an excursion, far less that she could enjoy it. 11th, 100 ma. 13th, 120 ma. 15th, 90 ma. 18th, 90 ma. 20th, 100 ma. for 5 minutes each. The patient now feels stronger, and walked a couple of miles yesterday. There is a decided difference in the size of the tumor, and there is now room to pass the finger between the part of the growth in the pelvis and the symphysis pubis, and so reach the cervix. The tumor has lost about one-quarter of its bulk.

In the end of January the lady called to report progress. She had had two natural periods, and was steadily gaining ground in every way; and with the advent of the menstrual flow, all dyspeptic symptoms, which had given rise to so much disturbance, vanished as if by magic. She said that the tumor continued to decrease, and it did not show through her clothes, as it had formerly done. She could "do anything."

In September she was in perfect health.

January 19th, 1889.—It is now fifteen months since the treatment was concluded, and for a year she said that she had been absolutely perfectly well. She certainly looked the picture of health; the lips were of a good color; the body was evidently well nourished; there was no dyspepsia; and the periods were said to last three days, and to recur every four

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weeks. She thinks that the tumor very slowly continues to decrease.

April 17th.—In a letter from Dr. Bruce, he speaks of the patient in the following terms:—"I saw Miss —— the other evening, and she is keeping remarkably well—a proof, which cannot be controverted, of the success of the new treatment."

CASE XXVIII.—Single, age 41; came to Edinburgh in September, 1887. She was sent by Dr. Nivison, of Castle-Douglas.

The tumor was first noticed sixteen months ago, and of late has been growing rapidly. There is not any menorrhagia nor pain, but the lady complains of constant discomfort and a feeling of lassitude.

The tumor extends up to the level of the umbilicus on the left side, and scarcely so high on the right. The cervix is far back, and the introduction of the sound is difficult.

September 13th, 15th, 17th, 20th, and 22d, 40 ma. for 5 minutes. The tumor is one inch below the umbilicus, and the patient is to go home and return later on.

November 19th, 40 ma. for 5 minutes. The tumor is 2 inches below the umbilicus. 22d, 40 ma. 24th, 40 ma. 26th, 60 ma. 29th, 75 ma. for 5 minutes each.

December 1st, 125 ma. 3d, 95 ma. 6th, 100 ma. 15th, 100 ma. 17th, 100 ma. 20th, 115 ma. 22d, 100 ma. for 5 minutes each. The tumor is the same size as it was last month, but the old feeling of tiredness is gone. The sound was made negative on every occasion.

June 10th, 1889.—"I am sorry to say that the tumor is increasing; indeed, I think it is much larger now than when I was under treatment in Edinburgh. The flow is also increasing; last time it continued for a fortnight; but I seldom have much pain, and my general health is pretty good."

We know now that in this case the treatment was not continued nearly long enough. This patient will return for a proper treatment later on.

CASE XXIX.—Married, age 31; came from Kansas, U.S.A., with the intention of having the ovaries removed or hysterectomy performed.

For the last eight years the patient says that she has not known what it was to feel well. There has been constant pain in the sides and back, and the periods last from ten to four-

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teen days, and the amount of blood lost is said to be great and to be steadily increasing. For eight years she has been constantly under treatment, and in March, 1887, a fibroid tumor was removed after dilatation of the cervix. In April, the cavity of the womb was curetted, and this operation was followed by flooding. No treatment has given even temporary relief.

The patient is a tall, thin woman, with absolutely colorless face. The uterus is about twice its natural size, and the cavity measures 3½ inches.

The lady was very anxious to have an operation, as she had no faith in any less radical mode of treatment after her eight years' experience, and it was with difficulty that she was persuaded against it.

As the patient had come four thousand miles, and as she was never able to bear a strong current, forty-three applications were made, in half of which the exact strength of the current used is somewhat doubtful. The sound was always made positive.

September 14th, 16th, and 17th, 1887, 40 ma. for 5 minutes. The patient was exhausted after the first application, but now feels better. 19th, 60 ma. 20th, 40 ma. 21st, 40 ma. for 5 minutes each. Does not feel at all better, and is in very low spirits. 23d, 40 ma. for 5 minutes.

October 4th, 120 ma. for 5 minutes. The menstrual flow is over. It continued for nine days, and although the time was shorter the quantity of discharge was greater than it has been since April. 8th, 60 ma. 11th, 80 ma. 13th, 80 ma. 15th, 100 ma. for 5 minutes each. Thinks that she is perhaps a little better. 18th, 80 ma. 20th, 100 ma. 31st, 100 ma. for 5 minutes each. A second menstrual period is passed; in no respect any better than the last.

November 2d, 100 ma. 4th, 120 ma. 7th, 100 ma. 9th, 120 ma. 11th, 120 ma. 14th, 120 ma. 16th, 100 ma. for 5 minutes each. There has been a decided improvement in the last few days; and the pain in the back has been more bearable. 28th, 100 ma. for 5 minutes. The period is again over; it lasted eight days, and for the first half of the time was slight; now she feels depressed, and has had increased pain. Gaiffe's galvanometer was used. 30th, 90 ma.

December 2d, 100 ma. 5th, 100 ma. 7th, 100 ma. 9th, 110 ma. 12th, 160 ma. 14th, 135 ma. 23d, 75 ma. for 5 minutes

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each. There has been decidedly less flow. 26th, 75 ma. 28th, 60 ma. 30th, 50 ma. for 5 minutes each.

January 2d, 1888, 80 ma. 4th, 60 ma. 6th, 50 ma. 9th, 65 ma. 11th, 65 ma. for 5 minutes each.

February 22d, 100 ma. for 5 minutes. Has been in the country since the last sitting, and has gained 2 pounds in weight. As regards the period there is nothing to record. 24th, 27th, and 29th, 100 ma. for 5 minutes.

April 17th.—"You will be pleased to hear I have got over a period in eight days, and not much any day of the eight. It also was a week longer than usual of coming on. It is the very best I have had for several years."

June 18th.—"I have been at home five weeks, and I am very glad to be able to say I am still keeping better. I have passed the third period since I stopped the electricity; each one only lasted eight days, a great improvement on what has been these last eight years. I still think it lasts a little too long, but trust I may yet derive a little more benefit from the treatment. The two last times I did not have much chance to improve: first we had a very stormy passage out (fourteen days crossing), then it has been intensely warm ever since we arrived. Mr. —— and all my friends are well pleased with the progress I have made. All tell me I am looking much better now than I have done for a number of years."

Case XXX.—Married, age 32; was sent to Edinburgh, and came to the Woman's Dispensary on the 19th September, 1887.

Two years ago, an attack of pain drew attention to a tumor in the abdomen. This mass is slowly increasing in size, and the patient suffers from inconvenience from some pain, and from frequent calls to pass water. Although the patient appeared to be in very good health, and, as far as could be made out, did not suffer very greatly, yet something had to be attempted, as it was not possible, or at least not likely, that the tumor would not give trouble in the next twenty years.

On examination, a very hard tumor was felt, extending upward to 1 inch above the umbilicus; to the right, to within 1½ inches of the right iliac spine; and on the left, to within 1 inch of the iliac spine on the same side. The pelvis was tightly packed by the tumor, and the cervix was drawn up behind the pubes. The sound passed 5 inches forward in front of the tumor growth.

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September 19th, 40 ma. 21st, 80 ma. 23d, 40 ma. for 5 minutes each. The tumor is smaller, and the cervix is lower down. 26th, 40 ma. 28th, 40 ma. 30th, 60 ma. for 5 minutes each.

October 3d, 40 ma. for 5 minutes. The tumor is fully 2 inches below the umbilicus. 5th, 40 ma. 7th, 40 ma. 12th, 40 ma. 14th, 45 ma. 17th, 40 ma. 19th, 40 ma. for 5 minutes each. Says that she is feeling much better. 21st, 50 ma. 24th, 120 ma. 26th, 60 ma. 28th, 100 ma. 31st, 120 ma. for 5 minutes each.

November 4th, 120 ma. 7th, 100 ma. 9th, 100 ma. 11th, 100 ma. 14th, 100 ma. 16th, 80 ma. 18th, 90 ma. 21st, 95 ma. 23d, 95 ma. 25th, 120 ma. for 5 minutes each. Gaiffe's galvanometer was used to-day. 28th, 115 ma. 30th, 150 ma. for 5 minutes each.

December 2d, 150 ma. for 5 minutes. The tumor was punctured, as the cavity lay so much in front of the mass of tumor, and the needle was made negative. The tumor is not within 3 inches of the umbilicus.

After going home the patient wrote to say that she had swelled considerably, but had "dissolved again in the course of a few days." She promised to write again, but did not do so, and a letter of inquiry was returned marked "not known."

CASE XXXI.—Married, age 44; was sent for to come to the Woman's Dispensary, Edinburgh, in September, 1887.

This patient's history had, indeed, been a sad one. She said that she had been to every doctor in Edinburgh, and that no one had been able to do her any good. Although she had not been well for fourteen years, or, as her husband states, twenty-one years, she was not really very ill until she caught cold about seven years ago. At that time she was in the early months of pregnancy. She was in bed for some weeks, and aborted. Since then her business has apparently consisted in trying to get well—at least during those times that she was not in bed. She had been an in-patient under the care of Professor Simpson and the late Dr. Angus Macdonald; and some two years ago, she was in the special ward for the treatment of ovarian disease. All of the usual remedies had been tried over and over again, and her recuperative power appeared to be so slight that operation could not be advised, more espe-

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cially, as it seemed to be probable that it would be difficult, or perhaps impossible, to remove the ovaries. After three months' experience in the use of Dr. Apostoli's method, and being confident that the general tonic effect of the treatment would more than counterbalance any disturbance the passage of a sound might cause, the woman was sent for, and came for treatment on the first day she was able to be out of bed, three weeks after she got the message.

Patient is a thin, dark, sallow woman. On examination of the abdomen, an irregular tumor was felt lying against the abdominal wall, and extending to 3 inches above the pubes. In the pelvis, the cervix was found to be situated far back, and a part of the growth pressed on the bladder. The sound passed to a depth of 4¼ inches. The patient states that she has been in constant pain for the last seven years, and for fifteen years there has been a steadily increasing quantity of blood lost at the periods. Before, and for the first few days of the menstrual flow, pain is very much aggravated, and prevents her from sleeping. Menstruation now lasts for fourteen days, and recurs after an interval of one week; formerly, its duration was seven days, with a twenty-one days' interval. This was a very satisfactory case for the treatment, as there appeared to be a very general consensus of opinion that any operation would be attended by great danger to life.

September 21st, 40 ma. 23d, 50 ma. for 5 minutes each. Says that she feels stronger already.

October 3d, 40 ma. for 5 minutes. The period came on ten days ago; the loss of blood has been greater than usual, and the patient feels very ill. 5th, 40 ma. for 5 minutes. The bleeding stopped after the last application. 12th, 40 ma. 14th, 70 ma. 17th, 70 ma. 24th, 80 ma. for 5 minutes each. A second period since the treatment was begun is over. It lasted seven days, was not very severe, and there was an interval of two weeks instead of the usual seven days. 28th, 120 ma. for 5 minutes. There has been some bleeding for two days. 31st, 120 ma. for 5 minutes.

November 4th, 120 ma. for 5 minutes. Feels better and stronger, and looks more cheerful. 18th, 100 ma. for 5 minutes. Has been flowing for five days. Feels much better, is stronger, and can walk better, and has little pain. 25th, 135 ma. for 5 minutes. To-day was the first time that the strength

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of current recorded is certainly correct. Has been "ill" again for five days, but is feeling wonderfully well. 28th, 155 ma. for 5 minutes.

December 5th, 135 ma. for 5 minutes. There has been rather more pain. 9th, 135 ma. for 5 minutes. The pain is relieved; there has been some hemorrhage for three days. 12th, 100 ma. for 5 minutes.

January 6th, 1888, 160 ma. for 5 minutes. Feels well, although there has been as great a loss of blood as she has ever had. The general health is undoubtedly much improved. 8th, 160 ma. 23d, 145 ma. 30th, 110 ma. for 5 minutes each. Flow six days. Does not feel strong.

February 3d, 130 ma. for 5 minutes. Is feeling better again. The weakness complained of at last visit was probably due to some little stomach derangement. 10th, 135 ma. 13th, 140 ma. 27th, 275 ma. for 5 minutes each. The period on this occasion lasted nine days; there was much less flow and much less pain. 29th, 220 ma. for 5 minutes.

March 2d, 250 ma. 5th, 230 ma. for 5 minutes each. The patient says that she feels quite well to-day, and has not done so for ten years. 9th, 245 ma. 19th, 270 ma. for 5 minutes each. There has been less loss during the menstrual period, which is just passed, than there has been for a long time. There was, however, more of the old pain for the first two days. 21st, 220 ma. 23d, 225 ma. 26th, 200 ma. 28th, 210 ma. 30th, 235 ma. 31st, 210 ma. for 5 minutes each.

April 2d, 210 ma. for 5 minutes.

The internal electrode was, in every one of the thirty-seven applications, attached to the positive pole of the battery.

Progress has been uninterrupted; and to-day the patient broke down completely. She has experienced what it was to be well, and was in terror lest the result of the treatment should not be permanent, and that there would be no one, as far as she knew, who would be able to give her relief. The following extract from a letter, dated 5th February, 1889, will show that her alarm was groundless, at least in the mean time: "My period now comes once a month, and lasts a week. I have pain a day or two before, and rather worse the first day of the period, but nothing to what it was before the electricity. My general health had been bad since the pain began. I have not felt so well for twelve years. After the treatment

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was stopped I gradually got stronger, and have never been laid up a day since you left Edinburgh. I am able to walk without pain or discomfort of any kind, and can't feel grateful enough to you for all your kindness."

CASE XXXII.—Married, age 29; came to the Woman's Dispensary, Edinburgh, in July, 1887.

The patient gave the following history:—She had been married five years, had never been pregnant, and had enjoyed good health until three years ago. At that time she was in bed for some weeks with "inflammation." For this she was treated in the country with hot-water injections and glycerin pads. Two years afterward she moved into town, and then consulted one of the younger medical men in Edinburgh. Treatment by glycerin pads was continued for nine months, the patient attending twice a week. At the end of that time she was told that she was incurable without an operation, and as one result of the operation proposed would be that she would have no children, it is to be concluded that removal of the ovaries was alluded to. She then came to the dispensary, complaining of constant severe pain in the left side, and of general debility. Menstruation regular, and as it had always been as regards quantity. Pain much worse at that time.

On examination, the cervix uteri was felt to be pointing forward, and the fundus to be in the hollow of the sacrum. The retroversion was evidently caused by the weight of a fibroid tumor, the size of a billiard ball, which was attached to the posterior part of the fundus. The uterine cavity measured 3¼ inches, and there was little mobility due to surrounding swelling. As efforts to replace the organ were of no avail, treatment by electricity was begun on the 21st September, the negative electrode being placed inside the uterus, and a current of about 40 ma. allowed to flow for 5 minutes. There was less pain after the first application; she felt able to do her housework after the second on the 23d; the period was commencing on the 28th inst. when she had the fourth. The fifth was on the 10th October, after an extremely easy menstrual flow. The ninth sitting was on the 4th November, immediately after a second period, which had been somewhat painful. The tenth application was made on the 11th, the direction of the current being reversed in this and the subsequent applications. November 28th, 125 ma. for 5 minutes

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The period is just over; scarcely any pain, and feels very well.

December 5th, 100 ma. 12th, 85 ma. for 5 minutes each.

January 6th, 1888, 130 ma. for 5 minutes. The uterus can now be turned forward with the sound. 20th, 130 ma. for 5 minutes. Constant desire to pass water for the last four days, and the period was not got over so easily. 23d, 115 ma. for 5 minutes. The bladder irritability is better to-day. 27th, 95 ma. 30th, 100 ma. for 5 minutes each.

February 20th, 135 ma. for 5 minutes.

March 19th, 130 ma. for 5 minutes. The easiest period she has had for more than three years; rather more flow, and more natural (*sic*). 21st, 170 ma. 23d, 180 ma. 26th, 160 ma. 28th, 170 ma. 30th, 175 ma. for 5 minutes each.

April 4th and 6th, 150 ma. for 5 minutes.

The period has been exactly as it used to be years ago. There were twenty-seven sittings—nine negative and eighteen positive—with the local result as follows: Loss of tenderness, loss of fixation, marked reduction in the size of the tumor and also of the uterus generally.

In September the patient was very well; there was simply a little pain at the time of the flow every month.

January 19th, 1889.—In perfect health; no pain, and says that she feels "awful well," and there is no doubt but that she looked it.

Case XXXIII.—Single, age 40; was sent by Dr. Joseph Bell in September, 1887.

As this lady had to earn her own living, and as her occupation required that she should stand most of the day, it was necessary that she should be strong and enjoy good health.

The tumor was first noticed sixteen months ago. At that time she was feeling weak and unfit for work, and was losing too much blood every month. The periods, which formerly lasted but three days, now continue for from seven to ten; and instead of coming every three weeks, appear at irregular intervals. A long rest in the country has greatly improved the general health. At present she feels full and uncomfortable, and cannot go up-stairs without a rest. She fears that, as there has not been any improvement in the menstrual function, she will soon be unable to work.

The tumor was found to extend up to the umbilicus; the

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cervix was far back, and the sound could be passed with considerable difficulty to a depth of 3 inches.

Twenty-four negative applications were made, the great majority in the evening, as the patient was employed during the daytime.

At no time was the patient able to stand a strong current, though it was only toward the end of the treatment that it could be correctly measured.

September 24th, 1887, 40 ma. 27th, 80 ma. 29th, 120 ma. for 5 minutes each. There is already a decided difference in the size of the tumor.

October 1st, 100 ma. 4th, 85 ma. for 5 minutes each. Every day the tumor is noticed to be smaller, and is now fully 1 inch below the umbilicus. 6th, 80 ma. for 5 minutes. Patient says that she feels smaller, and that her jacket is looser. She can now go up-stairs without a rest, and without panting for breath. 8th, 75 ma. for 5 minutes. Feels fuller to-day, and the tumor is within half an inch of the umbilicus. 10th, 80 ma. for 5 minutes. The tumor is smaller again to-day. 18th, 60 ma. for 5 minutes. Has had a remarkably easy period; very little pain, and less discharge. 20th, 60 ma. 22d, 50 ma. for 5 minutes each. There has been a good deal of pain for a day or two. 25th, 55 ma. for 5 minutes. The pain has gone. 29th, 60 ma. for 5 minutes.

November 3d, 40 ma. 6th, 35 ma. 15th, 40 ma. for 5 minutes each. There has been more loss than usual, but unaccompanied by pain, and now feels well and not so "puffy." 19th, 40 ma. 22d, 40 ma. 29th, 50 ma. for 5 minutes each.

December 13th, 55 ma. for 5 minutes. The period is over, and again there has been more discharge than usual. Gaiffe's galvanometer was used for the first time during the last application. 15th, 65 ma.

January 10th and 14th, 1888, 50 ma. for 5 minutes. 21st, 65 ma. for 8 minutes.

September.—Has not been an hour off work since January. The flow now lasts four days.

January 19th, 1889.—The periods last four or five days, and recur at regular intervals of three weeks. She says that she has nothing to complain of, and is "perfectly well, cannot tell how well." She told me that a short time ago she had met Dr. Bell, who said to her, "If you are half as well as you look, you would be a credit to any one." Sleeps splendidly now.

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CASE XXXIV.—Married, age 44; was sent to the Woman's Dispensary, for the electrical treatment, by Dr. M'Gibbon on the 28th September, 1887, as she was afraid that she would not be able to survive the frequent and great losses of blood if something were not done.

The patient had been quite well until about three years ago, when she began to notice that her periods were becoming unduly prolonged; that the quantity of blood lost was greater, and the interval between the flow was shorter. All those symptoms rapidly became worse, and, in addition, there was a profuse discharge of whites, so bad that she was never dry. She became anæmic, breathless, unable to walk, unable almost to do anything, in spite of ergot and careful attention to diet.

When first seen she looked very ill; lips and tongue without color, face greenish-yellow, breathless, and exhausted; legs much swollen with œdema, and she had not been able to walk to the dispensary.

Examination of the abdomen revealed the fundus of the uterus 2 inches above the pubes. In the pelvis the cervix was felt to be low down, deeply lacerated, with everted lips, and attached to the inner surface of the anterior lip was the tip of the tumor, which appeared to be incorporated with the anterior wall of the uterus. The cavity measured 3½ inches.

The periods now last twelve days, and recur regularly every month.

The treatment was begun on the 28th September, and repeated on the 30th—the strength of the current being about 40 and 50 ma., passed for 4 minutes. She felt better; there was less white discharge, and she was able to walk to the dispensary, as it was down-hill all the way from her house.

October 3d, 40 ma. 5th, 60 ma. for 4 minutes each. 7th, 40 ma. 10th, 50 ma. 12th, 40 ma. 14th, 80 ma. 17th, 85 ma. 19th, 50 ma. 26th, 50 ma. for 5 minutes each. She is immensely improved, can walk home, and does not look such a ghastly object as she did a month ago. The first period since the treatment was begun is just over. Instead of twelve, it lasted four days; and on three of those four, the discharge was comparatively slight. The leucorrhœa is stopped. The legs do not swell so much. 28th, 85 ma. 31st, 120 ma. for 5 minutes each.

November 2d and 4th, 120 ma. for 5 minutes. 7th, 9th, 11th,

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14th, 16th, and 18th, 100 ma. for 5 minutes. 25th, 175 ma. for 5 minutes. To-day was the first day on which the measurement was correct; the previous numbers are approximate only, though they are probably not very far wrong.

The period is again over; it came on after a month's interval, and lasted five days. The amount of blood lost was rather more than on the last occasion. The growth, which had been seen as an excrescence on the inner surface of the anterior lip of the cervix, does not now project. 28th, 155 ma. 30th, 175 ma. for 5 minutes each.

December 2d, 155 ma. 5th, 145 ma. 12th, 110 ma. for 5 minutes each.

January 4th, 1888, 200 ma. for 5 minutes. The period has again lasted five days, and in spite of there being more loss, the patient does not feel so pulled down and debilitated by it. There has been no return of the white discharge. The legs are still somewhat swelled at night. In the morning there is scarcely any œdema.

The last application was made on the 6th January, and for some reason or other a current of only 80 ma. could be borne. Twenty-nine positive applications in all.

On the 4th April she came to say that she was steadily improving in health, though there was more blood lost every month than had been her habit before the illness. There was, however, not any leucorrhœa.

In September she was very well indeed, and was able to attend to her shop all day. She was not breathless, looked well, and the periods lasted eight days, with little quantity.

In January, 1889, I was unable to find her, but was told by another old patient, who had seen her two or three weeks before, that she was quite well in every respect.

Having heard in May, 1889, that this patient had undergone an operation, she was communicated with, and wrote to say that a tumor had been removed from the vagina, and that there had been persistent hemorrhage after the operation, necessitating "plugging" seven times. She goes on to say that she was beginning to lose as much blood as she did before the electrical treatment, and ends her letter thus: "I always say, if it had not been for the battery, I would never have lived."

This result is what experience has shown Dr. Apostoli's

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treatment does for submucous tumor: it reduces the size, and makes them more or less pediculated. When treated by electricity, the tumor was part and parcel of the anterior wall of the uterus.

The tendency which the electrical treatment appears to have in causing, or at least in hastening, the expulsion of fibroid tumor situated near to the uterine cavity has been especially remarked on by Dr. La Torre, of Rome.

CASE XXXV.—Married, age 49; was sent by Dr. Maxwell Ross, and was treated at the Woman's Dispensary, Edinburgh.

Her history was that she had had constant pain in the back for five years, and that this had been accompanied by very profuse loss every month, the periods lasting usually fourteen days.

On examination, the top of the uterus was felt 2 inches above the pubes. In the pelvis, the cervix was found to be large, lacerated, and situated low down. The sound passed to a depth of 3¾ inches.

This was evidently a case where the internal electrode would have to be attached to the positive pole of the battery, and this was done in every one of the twenty-eight applications which were made.

September 28th, 40 ma. for 3 minutes. 30th, 40 ma. for 5 minutes.

October 5th, 40 ma. for 4 minutes. 7th, 40 ma. 17th, 70 ma. for 5 minutes each. The period has been going on for a week, and an attempt was made to stop it with the current. This it did most effectually. 21st, 55 ma. 24th, 80 ma. 28th, 80 ma. 31st, 60 ma. for 5 minutes each.

November 4th, 60 ma. 11th, 60 ma. 14th, 80 ma. 21st, 80 ma. for 5 minutes each.

December 2d, 110 ma. for 5 minutes. The strength of the current was measured to-day for the first time with accuracy. The period, after lasting twelve days, is over, and the total quantity is not more than was often lost in a single day. 5th, 115 ma. 9th, 100 ma. 12th, 120 ma. 19th, 100 ma. for 5 minutes each.

January 4th, 1888, 120 ma. 8th, 180 ma. 29th, 115 ma. for 5 minutes each. Has just got over a very bad period, which has lasted for two weeks. There had been nothing seen for the previous six weeks.

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March 2d, 220 ma. 7th, 180 ma. 9th, 160 ma. for 5 minutes each. The patient has been steadily improving since the end of last month, and says that she feels better than she has done since the month of November. 14th, 175 ma. 21st, 180 ma. for 5 minutes each. There has been a very easy period. 26th, 150 ma. 30th, 135 ma. for 5 minutes each.

What has been the exact result in this case will be shown by an extract from a letter written by Dr. Ross, who was good enough to see the patient and report, on the 5th February, 1889: "I called on Mrs. —— yesterday. She informed me that for a short time after the Apostoli treatment stopped she felt better generally. Her system was quieter, and she was less nervous. The hemorrhage is now much less than it was, but still comes at irregular intervals. In September last, she says she was seized with a shivering and a profuse discharge of blood, and slime came from the bowel. She also suffered from severe backache, and when she uses the vaginal douche, which she does frequently as it gives her relief, a clear but thick discharge comes away per anum 'from the back,' she says. She added that she felt at times that she would like to have the battery treatment again, but is hopeful, as the hemorrhage is diminishing, that she may now be recovering from her womb trouble. I did not examine her, and, in fact, up till yesterday had not seen her since you left Edinburgh."

CASE XXXVI.—Single, age 37; was sent into Edinburgh by Dr. Bannerman, of Hawick, and was treated at the Woman's Dispensary.

The patient did not know that there was anything the matter with her until August, 1886. A few days before the period she was unable to empty her bladder, and the water had to be drawn off with a catheter. This has had to be repeated every month. The woman is a worker in a mill, and for a year had had to give up work for about one week out of every four. With the exception of this trouble with the water, the tumor, which was only discovered when the catheter was first passed, has given rise to little disturbance.

On examination of the abdomen, a hard, somewhat nodulated tumor was felt extending up to the umbilicus. The pelvis was filled by the mass to within 2 inches of the vaginal outlet, and the os was not to be felt, the vagina stretching away in front.

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Treatment.—As the os uteri was not within reach, the centre of the mass in the pelvis was punctured to the depth of half an inch, and the current passed through the tumor on fourteen occasions. The figures given below are not absolutely correct.

September 28th, 1887, 40 ma. for 5 minutes.

October 2d, 40 ma. for 5 minutes. Menstruation is over; there has not been retention, and the tumor does not reach to within 1 inch of the umbilicus. 5th, 40 ma. 7th, 40 ma. 12th, 30 ma. 14th, 50 ma. 17th, 35 ma. 19th, 40 ma. 24th, 70 ma. for 5 minutes each. The second period since the treatment was begun is over. Again the catheter was not required. 26th, 60 ma. 28th, 70 ma. 31st, 100 ma. for 5 minutes each.

November 2d, 100 ma. for 5 minutes. 4th, 100 ma. for 7½ minutes. The patient now feels very well. The tumor is decidedly smaller in the pelvis; it reaches almost up to the level of the umbilicus on the right side, and is fully 3 inches below that level on the left. The os uteri is now easily within reach.

On March 10th, 1888, she wrote to another patient, telling her that she had not the slightest ailment; that she had not required to have the water drawn off; and that she had not required to ask leave of absence even for five minutes, and this although they had been working over-time.

July 11th, 1889.—Dr. Bannerman wrote that this patient had never experienced any inconvenience since the electrical treatment.

Case XXXVII.—Single, age 44; consulted Dr. Keith four years ago, and was told that she had a fibroid tumor of the uterus; but at that time her health was quite good.

The history of this case dates back to eight or ten years ago, as it was about that time that it was first noticed that the loss every month was increasing in quantity. It is only two years, however, since the loss became so great as to affect the general health, and during those years the tumor has increased with comparatively great rapidity. The mass was originally situated entirely in the right side, but of late has increased so as to fill the left side also. The flow now continues for seven or eight days, and the patient is in bed for two or three of them. In addition to the loss, she finds that many things which she could do formerly, she either cannot do now or can accomplish only with an effort.

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The treatment consisted in thirty-five applications, in the first seven of which the internal electrode was made positive, and in the remainder negative. Gaiffe's galvanometer was used after the fifteenth application. During the first half of the treatment the lady lived in Edinburgh; in the second half she came through from Glasgow twice a week, and by a convenient arrangement of trains, she was able to be back at home within three hours.

On examination of the abdomen, the tumor was found to reach to fully 1 inch above the umbilicus on both sides, and to be smooth and regular in outline. The cervix was situated immediately behind the pubes, and a sound entered, after curving first to the left and then very much back, to a depth of 6½ inches.

September 29th, 1887, 40 ma. for 5 minutes.

October 1st, 70 ma. 4th, 50 ma. for 5 minutes each. 6th, 8th, and 11th, 100 ma. for 5 minutes. The period has begun to-day, a week too soon. The tumor does not reach up to the umbilicus on either side. 22d, 100 ma. for 5 minutes. This period has been the worst she has ever had. 25th, 90 ma. for 5 minutes. The outline of the tumor is becoming broken up, and there are now several distinct lobules. 29th, 120 ma. for 5 minutes.

November 1st, 2d, and 5th, 120 ma. for 5 minutes. Begins to feel a decided improvement in the general health. 9th, 11th, and 12th, 120 ma. for 5 minutes. 26th, 75 ma. for 5 minutes. The second period is over. It was again worse than usual, though not so severe as the previous one. Gaiffe's galvanometer was used to-day. 29th, 65 ma. for 5 minutes.

December 1st, 110 ma. 3d, 75 ma. for 5 minutes each. The tumor now is much lobulated, and is smaller on the left side. 6th, 80 ma. 8th, 150 ma. 10th, 130 ma. for 10 minutes each. 21st, 150 ma. for 5 minutes. This month the period lasted but four days, and there was less loss than the patient ever remembers to have had.

January 4th, 1888, 150 ma. for 5 minutes. 7th, 150 ma. 19th, 175 ma. for 10 minutes. There has been more discharge, but much less than usual. 21st, 150 ma. 25th, 170 ma. 28th, 155 ma. for 10 minutes each.

February 1st, 190 ma. 14th, 180 ma. for 10 minutes each. A very slight period, lasting three days, is over, and the lady

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feels well and strong. 18th, 175 ma. 22d, 190 ma. 25th, 185 ma. 29th, 190 ma. for 10 minutes each. There is now not much tumor to the left of the middle line, and on the right it reaches to within 1 inch of the umbilicus.

August 9th.—An opportunity was given of examining the tumor, which was found to be more lobulated, but of much the same size as it was in February. The general health is fairly good, the periods are normal, there is a natural quantity of blood lost, and there is not any necessity to go to bed.

May 3d, 1889.—The tumor is rather smaller than it was in August. The periods last for four days, and for two of these the lady keeps quiet in bed. The growth of the tumor has been arrested, the monthly losses have been lessened, and the general health has been improved.

CASE XXXVIII.—Single, age 37; from Glasgow.

For a number of years this lady has been more or less of an invalid, and has had to go abroad every winter. She ascribes her ill health to the circumstance that she suffers every month from prolonged and profuse menstrual discharge, the flow continuing for eight days, and to a feeling of wretchedness and depression at these times. Treatment of all kinds has been tried; but in spite of it all, each year sees her a little weaker, and with a greater loss at the periods.

On examination the cervix uteri is found to be situated far back in the pelvis, and the fundus to be lying against the abdominal wall above the pubes. A sound can be passed, with considerable difficulty, to a depth of four and a half inches. The pelvis is full of tumor, which can be felt some inches above the pubes all across the pelvis.

Thirty-six applications with the positive pole in the uterine cavity were made.

September 20th, 1887, 40 ma. for 5 minutes

October 3d, 40 ma. for 5 minutes. The patient was very tired after the first application. 5th, 7th, and 24th, 40 ma. for 5 minutes. The period is over, the quantity of blood lost was much the same as usual, but the discomfort and feeling of depression was absent, and to-day the patient feels stronger than usual. 26th, 40 ma. 28th, 60 ma. 31st, 40 ma. for 5 minutes each. The lady says that she feels in every way much better, is stronger, and can walk farther and with more comfort.

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November 2d, 80 ma. 4th, 120 ma. 18th, 40 ma. for 5 minutes each. There has been a greater loss of blood than usual. 21st, 50 ma. 23d, 60 ma. 25th, 60 ma. 28th, 155 ma. for 5 minutes each. Gaiffe's galvanometer was used to-day. The patient continues steadily to improve. 30th, 140 ma.

December 2d, 115 ma. 5th, 135 ma. 7th, 90 ma. 9th, 100 ma. 21st, 125 ma. for 5 minutes each. The loss this month was less than it has been for some time. 23d, 125 ma. 26th, 115 ma. 28th, 125 ma. 30th, 175 ma. for 5 minutes each. The patient now walks very much better, and is quite satisfied with the progress that she is making.

January 2d, 1888.—125 ma. 4th, 150 ma. 6th, 135 ma. 10th, 150 ma. 12th, 175 ma. 14th, 175 ma. 16th, 160 ma. 23d, 115 ma. for 5 minutes each. This month there has been less discharge than for many years; and to-day, instead of feeling ill and sore, the patient says that she feels about as well as she ever did in her life. 25th, 130 ma. 27th, 140 ma. 30th, 150 ma. for 5 minutes each.

October.—Has been quite well.

June 25th, 1889.—Periods natural and feels well. The tumor is now freely movable, scarcely to be felt in the pelvis, and the cervix is in front instead of being almost beyond reach.

Case XXXIX.—Single, age 47; was seen with Dr. Finlay, of Trinity.

This patient has been ailing for some years; she cannot walk as far as she used to be able to do, and when she stands there is a good deal of pain, especially in the left side. There is also menorrhagia, which is steadily becoming worse. The tumor was noticed fifteen months ago, and is now very decidedly larger than it was at that time. She is a woman who will not take care of herself, and does what she likes as the fancy takes her.

The tumor is round and prominent, and extends from half way up to the umbilicus to low down in the pelvis. The cervix is small and situated far back.

October 7th, 1887.—100 ma. 11th, 100 ma. 13th, 175 ma. for 5 minutes each. Feels more comfortable. 15th, 150 ma. 29th, 125 ma. for 5 minutes each. The period has been much as usual, but accompanied by more pain.

November 1st and 3d, 100 ma. for 5 minutes.

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January 12th, 1888, 140 ma. for 5 minutes. The patient had been so well until the last few days that she did not think it necessary to come for treatment. 14th, 125 ma. 17th, 100 ma. 19th, 170 ma. for 5 minutes each.

February 7th, 130 ma. for 5 minutes. The period has been decidedly worse than usual; now she feels better. 9th, 160 ma. 11th, 170 ma. 14th, 175 ma. for 5 minutes each.

March 1st, 180 ma. 3d, 180 ma. 6th, 175 ma. 8th, 190 ma. 10th, 190 ma. 28th, 180 ma. 30th, 180 ma. for 5 minutes each. The sound was always made positive.

Having heard that we were leaving Edinburgh the patient became very anxious to have more treatment.

Dr. Finlay wrote on the 11th June, 1889: "Miss —— had distinctly less bleeding for three months after the electrolysis, and also felt more comfortable and had less feeling of fulness from the tumor. Since then she says she has been much as before, and will not allow that she has derived permanent benefit from the treatment. In her case I can feel the tumor in the left iliac region from the outside on deep pressure and also from the vagina. I see Miss —— occasionally on account of eczema from which she suffers, and her general health appears to me to be wonderfully good."

CASE XL.—Married, age 31; came to the Woman's Dispensary on the 7th of October, 1887.

Patient has been married for three years, and enjoyed fairly good health until six months ago, although for many years there has been some pain in the back, which has always been worse during menstruation. For two years there has been considerable feeling of weight and discomfort. Half a year ago the tumor was noticed, attention being called to it by a pain described as if a hand were inside the abdomen tearing at something.

Menstruation has been normal, except on one occasion, when, after having been examined by a number of students in the infirmary, there was said to have been a flooding. She says she is very uncomfortable before the menstrual periods from swelling of the tumor. A very hard, prominent tumor extends up to the level of the umbilicus. There is no mobility of the mass, which is somewhat tender. In the pelvis, the tumor is felt also to be quite immovable, and a small cervix is reached with great difficulty, very high up on the right

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side. Any attempt to remove the ovaries would probably have been unsuccessful. The patient, a tall, well-made woman, looked very miserable and ill.

At the first nine sittings the strength of the electrical current recorded is probably not exact.

October 7th, 40 ma. 10th, 40 ma. 14th, 35 ma. 17th, 45 ma. for 5 minutes each. On account of the difficulty in reaching the os, and consequently in passing the sound, it was thought best to puncture the centre of the mass in the pelvis to the depth of one-third of an inch. After the first application even, there was an improvement; the patient looked and said she felt better, and there was a decided diminution in the size of the tumor. The first four applications reduced the level of the tumor to 2 inches below the navel, made it more movable, and allowed of the fairly easy passage of a sound. 31st, 40 ma. for 5 minutes.

November 4th, 50 ma. 11th, 50 ma. 14th, 70 ma. 18th, 50 ma. 28th, 65 ma. for 5 minutes each.

There have been two periods, before which the discomfort due to swelling of the tumor has been absent; the patient feels very well, and there is a vast difference in her appearance.

December 2d, 75 ma. 5th, 70 ma. 9th, 125 ma. 12th, 135 ma. 16th, 115 ma. for 5 minutes each. The tumor is much smaller, is more movable, and can be handled without producing discomfort.

January 6th, 1888, 140 ma. 8th, 160 ma. 10th, 145 ma. 13th, 135 ma. 27th, 50 ma. for 5 minutes each. At the beginning of the year there was pain in the tumor for some days. This was relieved by a single application. The tumor had not become swelled, and there was not any apparent cause for the return of pain—neither tenderness nor fixing. The period was passed through quite easily, except for a "queer" feeling low down. 30th, 120 ma. for 5 minutes.

February 3d, 145 ma. 6th, 160 ma. 24th, 140 ma. 27th, 140 ma. 29th, 135 ma. for 5 minutes each.

March 2d, 145 ma. for 5 minutes. The relation of cervix to the tumor has improved, so that, since the 30th January, it has not been necessary to resort to puncture. The period in February was passed through easily; there was not any swelling, and but little pain. 5th, 260 ma. 7th, 190 ma. 9th, 200 ma. 23d, 185 ma. 26th, 220 ma. 28th, 230 ma. 30th, 235 ma. for 5 minutes each.

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April 2d, 160 ma. 4th, 150 ma. 6th, 200 ma. for 5 minutes each.

The treatment consisted in thirty-seven applications; in twenty puncture was employed; and the puncture of one day was never detectable even when the next one was made two days afterward. The result was a diminution of the tumor by at least one-half, and a complete change for the better in the general health of the patient.

In September the tumor was smaller than it had been in April, but there was considerable pain in the groins after the periods, and when this was bad she was very miserable.

June, 1889.—Have heard that she has been a patient in the infirmary, and that she has been sent home without anything having been done. This is not altogether surprising, as she was a difficult woman to manage.

CASE XLI.—Married, age about 37; was seen with Dr. Burn Murdoch in October, 1887.

Nine years before this time patient had been seen on account of a fibroid tumor of the uterus shortly after an attack of rheumatic fever, which had left the heart in a very weak condition. At that time, there were occasional hemorrhages from the kidneys. Now the general health is very poor, and there is great abdominal discomfort, with pain in the back. Until the last period there has not been excess in the menstrual flow.

The lady looks ill and miserable, and on examining the abdomen, a very large hard tumor, extending up beneath the ribs on both sides, is seen. The tumor is not movable, and is very prominent and gives rise to great difficulty in walking. The uterine cavity measures 8 inches. The treatment consisted in thirty applications—twenty-three in which the internal electrode was positive, and seven in which it was negative. Gaiffe's galvanometer was not used until the ninth sitting.

October 10th, 1887, 40 ma. 12th, 30 ma. 14th, 40 ma. 17th, 50 ma. for 5 minutes each.

November 18th, 70 ma. for 5 minutes. The treatment has been stopped for the last month on account of an attack of rheumatism. 21st, 65 ma. 23d, 70 ma. for 5 minutes each. The patient says that she is beginning to feel stronger, and can sleep better; she can also get about with more comfort. 25th, 70 ma. 28th, 75 ma. for 5 minutes each. Gaiffe's galvanometer was used to-day. 30th, 75 ma. for 5 minutes.

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December 9th, 110 ma. for 5 minutes. A perfectly natural period is over, and the lady is in great spirits, as she feels so much better. 12th, 165 ma. 14th, 215 ma. for 5 minutes each. 16th, 170 ma. for 8 minutes. 19th, 180 ma. for 10 minutes. 21st, 210 ma. for 8 minutes. The patient can now take what she calls a good long walk. The left side of the tumor is becoming much smaller. This was the side which has grown of late. 23d, 200 ma. for 8 minutes. 26th, 210 ma. for 5 minutes.

January 4th, 1888.—210 ma. for 5 minutes. The period has been again quite natural. 6th, 150 ma. 9th, 140 ma. for 5 minutes each. The sound has been made negative during the last two applications. The lady's husband measured her round the waist ten days ago, and again to-day, and finds that there is a diminution of 3½ inches. 16th, 210 ma. 18th, 250 ma. for 5 minutes each. The sound was again made positive, as the patient had had a great deal of domestic worry, and was afraid that she might have a bad bleeding. 30th, 175 ma. for 5 minutes. The period has been very slight, and lasted but three days. The tumor continues to decrease rapidly. The sound was negative.

February 1st, 210 ma. 3d, 200 ma. for 5 minutes each. The waist measurement shows one inch less in the past four weeks. 27th, 90 ma. for 5 minutes. Another easy period, in spite of measles, with accompanying bother, having appeared in the household. 29th, 130 ma. for 5 minutes. Feels splendidly well. Measures 32 inches round the waist instead of 37 on the last day of the year. On the right side the tumor is quite free of the ribs, and on the left there is a great hollow. The cervix is almost out of reach, and the tumor appears to be smaller by at least a half.

March 27th, 210 ma. for 8 minutes. 31st, 110 ma. for 10 minutes. These two positive applications were made on account of a painful spot on the right side, and gave complete relief.

September.—Tumor continues to decrease in size; the periods are regular, and there is not any pain, except very occasionally. Is better in every way than for the last eight years.

January 19th, 1889.—The tumor is still said to be diminishing in size. At times there is a spot on the left side which causes pain, but in every other respect the general health is perfect, and she has been able to do as much as most women.

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CASE XLII.—Married, age 24; came to the Woman's Dispensary, Edinburgh, on the 10th of October, 1887.

Until she was married in August, 1886, she had been a perfectly healthy girl. The uterine functions were normal and regular; the periods lasted three or four days, and recurred every four weeks. Very shortly after her marriage, she began to feel not so well as she had done, and to experience pain during coitus. Soon there were pains, at first at times, and latterly constant, in the back, right side, and down the right leg. The pain was so severe as to prevent her sleeping, and was always much worse at the commencement of a period. Six months after the marriage the menstrual flow lasted for three weeks, and was very abundant, and from that time she has rapidly gone down hill, and has got thin and anæmic. The periods now usually last for two weeks, and recur in seven, twelve, or fourteen days. For six months she has been in bed nearly all the time, and is quite unable to do her housework. The patient had never been pregnant.

On making a pelvic examination, the first thing noted was extreme tenderness, which rendered the examination somewhat difficult. The cervix was situated far back, and on placing the hand on the abdomen, a tumor of the uterus was felt, extending to within half an inch of the level of the anterior superior iliac spine. This tumor was situated principally in the right side and in front, and was immovably fixed, apparently by cellular swelling outside the growth; hence the dyspareunia.

Treatment.—The sound connected to the positive pole of the battery was passed into the cavity of the uterus, and currents of electricity of doubtful strength, but probably never exceeding fifty milliampères, were passed through the tumor for five minutes on each occasion, on the 10th, 14th, 17th, and 21st October, and 4th, 11th, 14th, and 18th November. After the second application she felt better; after the third there was increased pain in the back. Before the fifth there had been a period, very much the same as usual. Six applications improved her decidedly; she had little pain in the back, and was able to be out of bed all day, and to do her housework. The second period after the commencement of the treatment came on after an interval of nineteen days, and lasted only four days.

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November 28th, 45 ma. for 5 minutes.

December 2d, 50 ma. 5th, 75 ma. 9th, 65 ma. 12th, 60 ma. 16th, 65 ma. for 5 minutes each. The menstrual flow again lasted but four days, but was accompanied by more pain.

January 4th, 1888, 80 ma. 8th, 60 ma. 13th, 60 ma. 20th, 65 ma. 23d, 65 ma. 27th, 110 ma. 30th, 135 ma. for 5 minutes each. The flow this month lasted four days, and was still painful.

February 3d, 65 ma. 6th, 75 ma. 20th, 65 ma. 24th, 100 ma. 27th, 100 ma. 29th, 100 ma. for 5 minutes each. The period at the middle of the month was not accompanied by any pain. The tumor is smaller and less tender. Toward the end of the month there was some return of the backache.

March 2d, 75 ma. 5th, 190 ma. 14th, 85 ma. 19th, 110 ma. 21st, 105 ma. 28th, 130 ma. 30th, 120 ma. for 5 minutes each. There was not any pain with the menstrual flow this month, and the patient looks and feels very well, and much stronger.

April 2d, 125 ma. 4th, 90 ma. 6th, 95 ma. for 5 minutes each.

The tumor is fully 1 inch lower in the abdomen than it was six months ago; there is not much pain; there is not any menorrhagia, and the general health has much improved.

The treatment has consisted of thirty-seven applications, the positive pole being placed inside the uterine cavity.

On January 21st, 1889, I found this patient in perfect health, "feeling nothing at all the matter." Since the beginning of June she has been quite well; the periods last three or four days, and recur every four weeks with unfailing regularity. There is not any pain in the back, side, or leg, and dyspareunia is a thing of the past.

No tumor could be felt in the abdomen; in the pelvis the cervix was found to have moved forward to a natural situation; the body of the uterus felt a little big, there being barely a trace of the old tumor. There was complete mobility and no tenderness.

CASE XLIII.—Married, age 34, the mother of five children; was seen in consultation with Dr. Woolston in October, 1887.

The patient was a delicate little woman, whose general health had become much deteriorated by a greatly increased quantity of blood lost at the menstrual periods, and the flow now continues for eight, instead of three days. In addition,

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she suffers from frequent headaches, and has very considerable difficulty in walking, and is altogether in very poor condition.

On examination it was found that the uterus was large, swollen, and retroverted. The cavity measured 3½ inches, and the uterus could not be replaced with the sound unless undue force had been used. Situated in the left broad ligament, and connected to the left side of the uterus, was a mass about the size of a billiard ball. For some months a ring pessary had been worn, with great relief to the back.

The treatment consisted in twenty applications of electricity—the internal electrode being on every occasion connected to the positive pole of the battery. Gaiffe's galvanometer was used to measure the strength of the current in the last eight applications only.

October 11th, 40 ma. 13th, 40 ma. 15th, 40 ma. 18th, 60 ma. 25th, 80 ma. for 5 minutes each. The period is over, and there has been some improvement; it lasted five days, and there was less discharge. The lady feels stronger, and says that she can walk better, even although she is not wearing the pessary. 27th, 80 ma. for 5 minutes.

November 1st, 120 ma. 2d, 100 ma. for 5 minutes each. The patient feels stronger; the uterus is lighter, and can be replaced with the sound with care and without pain. The mass on the left side is smaller. 5th, 100 ma. 15th, 60 ma. for 5 minutes each. The period came on a week before its time, and although it has been going on for six days, and is not yet stopped, yet the patient does not feel weak and pulled down as she used to do. 17th, 70 ma. 19th, 70 ma. 29th, 160 ma. for 5 minutes each. Feels stronger, and says that her head feels much clearer.

December 1st, 155 ma. 3d, 100 ma. for 5 minutes each. Is feeling very well indeed. On the way home after the last application there was a good deal of pain felt in the lower part of the abdomen. 8th, 75 ma. 10th, 110 ma. 20th, 115 ma. for 5 minutes each. There is not any tumor to be felt on the left side. There has been much less loss this time.

January 3d, 1888, 75 ma. 7th, 110 ma. for 5 minutes each. Feels very well. The uterus is smaller, and can be easily turned forward, and there is not a trace of the outgrowth which was formerly attached to the left side.

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April 6th.—Is very well indeed.

September.—The periods now last two or three days; there is not any pain, nor any headache, and, in spite of the fact that her five children and herself have had whooping cough, she is now in excellent health.

Extract from letter received on 12th March, 1889: "I have had no return of any of the symptoms I had before I was under your care, and feel very grateful to you for making me so much better. The illness I have had lately was entirely owing to the whooping cough, which I had last autumn, accompanied by bronchitis, and which reduced my strength so much that in January I had another threatening of bronchitis, and was very weak. I am getting better now but may not venture out of doors yet."

CASE XLIV.—Single, age 37; came to the Royal Infirmary, Edinburgh, from Greenock, in January, 1887, and was admitted as an in-patient into the special ward for the treatment of ovarian disease.

The patient was a fair-haired woman who had to work for her living. The history was that, until the age of 29, she was quite well and regular in every way. About that age she began to lose more blood every month than had been habitual to her. At first, this did not cause alarm, but after a time, and when she found that she was not so strong as formerly, and that month by month she was slowly losing ground, she became anxious for treatment. As treatment, which she obtained in Greenock, did not do much good, she went to Glasgow and consulted Dr. Robert Bell two years ago. An enlargement of the womb was then discovered, and appropriate remedies ordered and persevered with for a long time with little, if any, good result. She is now confined to bed for at least one week every month.

Examination at this time revealed a uterine tumor extending to 3 inches above the pubes, and entirely filling the pelvis. It was useless to tell a patient, so ill as this one was, that she must wait until the menopause for twelve or fifteen years, so she was advised to submit to removal of the ovaries. As this was one of the cases where it was apparent that there would be probably difficulty in getting them out, the patient was told that, should it be found to be impossible to do so, no attempt would be made, at that time, to take away the tumor itself.

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On the 20th January, 1887, the operation was performed by Dr. Keith in the presence of Dr. Hodsdon and the usual number of students. As had been expected, the right ovary was found, after a prolonged search, incorporated with the tumor; the Fallopian tube was injured during the manipulation, and was removed. What appeared to be the left ovary was reached very far back, and also so situated that its removal would have necessitated injury to the tumor. Neither benefit nor injury followed the operation, and the patient went home in the same condition as she had come, except for the presence of a scar on the abdomen.

The patient returned in October of the same year, being anxious to try if electricity would do for her what surgery had failed to do. The tumor had grown rapidly, and now, instead of reaching only to 3 inches above the pubes, extends to the same distance above the umbilicus. The cavity measures 4½ inches.

Unfortunately, a galvanometer of doubtful accuracy was used to measure the strength of the current for the first fourteen applications. Forty-five applications were made altogether, the current being passed from the sound inside the cavity of the womb toward the clay pad on the abdomen.

October 15th, 30 ma. 17th, 40 ma. 19th, 80 ma. 21st, 100 ma. 24th, 70 ma. for 5 minutes each. The patient thinks that she feels a little stronger. 26th, 80 ma. for 5 minutes.

November 4th, 100 ma. for 5 minutes. The loss at the period has been more than usual; she was in bed for seven days; but there was none of the dysmenorrhœa which has been present for the last few years. 8th, 100 ma. 10th, 100 ma. 15th, 65 ma. 17th, 60 ma. 19th, 60 ma. 22d, 50 ma. 24th, 50 ma. 26th, 105 ma. for 5 minutes each. Gaiffe's galvanometer was used to-day.

December 6th, 100 ma. for 5 minutes. The second period is over; the loss of blood was much the same as last time and there was again little pain. 8th, 10th, and 13th, 80 ma. for 5 minutes. Thinks that she is gaining a little strength. 15th, 130 ma. 17th, 100 ma. 18th, 150 ma. 20th, 150 ma. for 5 minutes each.

January 3d, 1888, 150 ma. for 5 minutes. The third period has been much the same as the two previous ones; but the patient feels stronger than she has been accustomed to do im-

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mediately afterward. 5th, 150 ma. 7th, 150 ma. 10th, 175 ma. 12th, 175 ma. 14th, 175 ma. 17th, 150 ma. 19th, 170 ma. 21st, 165 ma. 28th, 160 ma. for 5 minutes each. In spite of a somewhat more profuse flow than usual the patient feels decidedly stronger. 31st, 150 ma.

February 2d, 200 ma. 4th, 150 ma. 7th, 220 ma. 9th, 210 ma. 11th, 230 ma. 16th, 220 ma. for 5 minutes each. The patient says that she feels better and stronger than she has done for six years. 18th, 210 ma. 25th, 180 ma. 28th, 220 ma. for 5 minutes each.

March 1st, 220 ma. for 5 minutes. At the last period, between the 18th and 25th ultimo, the patient required to be in bed two days instead of the usual seven, and the amount of blood lost was not more than half her usual. She is now able to walk better, feels stronger, and the tumor is about one-third smaller than it was. This patient was one of the few who took the trouble to write often and report how she was, after going home; and the following are extracts from her letters.

May 24th.—"I was rather worse this time my period was on; the time was the same, but the quantity was more than it was either of the last three times."

June 22d.—"I am sorry to say that my period this time was not any better, just the same as last time. I cannot say I feel any stronger than I felt when I left Edinburgh."

July 23d.—"I am glad to say that my period this time has been much better. I think there would be about half the quantity this time that there was either of the last few times, and it just continued six days. I think this time I would only have about five or six times more than it ought to be. I cannot say anything about the size of the tumor, but I think it must be much smaller, I feel so easy—not the swelled, crushed-up feeling I had; but if you would like to see, I would go in to Edinburgh a day either after my next period or after next again."

The patient was not aware at this time that we had left Edinburgh for London.

August 20th.—"I have been much the same this period as I was last, but I feel a difference in strength; the last three or four weeks I have been much stronger."

October 22d.—"I am sorry I cannot say that there has been any improvement since I wrote in August; last month

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and this one my periods have been much the same as the two previous; the quantity was about the same, but the time was one day longer (seven days). It is a year the middle of this month since I went to Edinburgh to have the electricity; I am greatly improved since then; then I had to be in bed six days, and up and down three or four; now I have just to keep my bed for two days, and three or four up and down."

December 15th.—"I am much pleased to be able to send a good report this time. My period last month was much improved, and this month the quantity was even less than last month, and it just continued five days. I had not to be in bed this time at all, just on the sofa a good deal for four days. I think the quantity now will only be three or four times more than it ought to be. I have not been able to gather very much strength yet, I get weakened down so much every month; but now the bleeding is so very, very much less, I think I should begin to pick up. I will let you know in three months how I get on. I am afraid I am troubling you writing to you so often."

March 18th, 1889.—"I am glad to say I continue to improve. My periods are better than when I wrote last, and I am also feeling stronger, although I cannot go a whole day yet without lying down to rest for about two hours. What a difference there is on me since this time last year!

"I will write in six months and let you know how I am then. I think if I improve the next six months as I have been doing I should be pretty well."

Case XLV.—Married, age 45; was seen with Dr. Finlay in October, 1887.

For a number of years this patient had suffered from menorrhagia, though it has only been serious for the last two. Sometimes the loss is said to be so bad as to amount to a flooding. A year ago some polypi were removed from the cervix, and since then there has been some slight improvement. In addition to the loss there is constant discomfort in the lower part of the abdomen and in the pelvis, accompanied by irritability of the bladder.

On examination, the tumor is found to be as large as a newly-born child's head, and to press very much on the bladder. The cervix is situated very far back in the pelvis, and the passage of a sound is a work of extreme difficulty. The depth of the uterine cavity is 3¾ inches.

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Nine applications were made, the sound being positive. The treatment had to be discontinued on account of the death of the lady's husband, and was not resumed on account of our removal from Edinburgh.

October 18th, 1887, 40 ma. 20th, 40 ma. 22d, 40 ma. 27th, 60 ma. 29th, 80 ma. for 5 minutes each.

November 10th, 80 ma. for 5 minutes. The quantity of discharge has been much the same as usual, but there has been less pain. 12th, 80 ma. 15th, 65 ma. 17th, 80 ma. for 5 minutes each.

Dr. Finlay wrote on June 11, 1889: "She says that she noticed no difference in the amount of the discharge; she has, however, never had to send for me since then on "account of profuse hemorrhage, as she used to have to do. She looks much better, and I am sure she is so."

CASE XLVI.—Married, age 29; was admitted into the Royal Infirmary, Edinburgh, in October, 1887.

At the beginning of the present year this patient was delivered of a still-born child. There was no particular difficulty at the birth, and there was not supposed to be any reason why it should have been followed by a constant discharge of blood for three months. The bleeding became so severe whenever the erect posture was assumed, that the great part of those months was spent in bed. From that time until admission into the infirmary, there has been very great menorrhagia every month, the flow lasting from ten to twelve days.

The woman is now blanched, and is able to do very little for herself, and says that she has been as many days in bed as out of it, since her baby was born.

On examination of the abdomen a uterine tumor is felt to extend to two inches above the pubes.

Before the treatment was commenced the quantity of urea excreted by the kidneys in twenty-four hours was estimated, and was found to average about 240 grains. The day after the first application it dropped to 172 grains, and then gradually rose to 236 grains per diem.

October 15th, 40 ma. 18th, 60 ma. 20th, 55 ma. 25th, 120 ma. for 5 minutes each. The period came on a week too soon; it did not continue for longer than half the usual time, and there was not so much loss, on the whole. She says that she feels stronger. 29th, 60 ma. for 5 minutes.

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November 1st, 60 ma. for 5 minutes. To-day the sound, which had previously been positive, was made negative. 3d, 5th, 8th, 10th, and 15th, 120 ma. for 5 minutes. Improvement in the general appearance has been very marked, and the patient says that she feels better than she has done for the last eighteen months. 17th and 24th, 120 ma. for 5 minutes. Menstruation has occurred at an interval of four weeks, and the loss has been less than there has been for five or six years. The patient says that she feels quite well. The tumor is smaller, but there is not a very marked difference in its size.

February 23d, 1888.—The late patient is now perfectly well; she has a good color and has got quite stout, and this in spite of the fact that she has had to nurse her husband for most of the time she has been at home, and has now brought him to the infirmary. She says that the tumor, which formerly felt to her like a big egg, is now not to be felt at all.

CASE XLVII.—Married, age 40; came to Edinburgh in October, 1887. Rather more than two years ago, a tumor which at that time could be felt above the pubes was discovered. For several years before this was found, the patient had been treated for displacement, she says. There is great trouble with the bladder, as sometimes there is difficulty in passing water, at other times difficulty in retaining it, and occasionally it comes away involuntarily on coughing. Menstruation is regular, but painful, the pain commencing for some days before the flow, which continues for seven days, and is becoming very profuse. Large clots are passed as a rule. On examination, it is found that the tumor extends almost up to the umbilicus, and is said to swell enormously before the periods. The mass is felt to descend very low into the pelvis, there is no cervix, and the os can be felt with difficulty very high up in front.

At first it was found to be necessary to make punctures, though, later on, and when the growth had diminished in size, a sound could be passed into the uterine cavity. The current was always allowed to flow from the abdomen to the puncturing needle or sound.

October 24th, 35 ma. 26th, 30 ma. for 5 minutes each. Has slept better. 28th, 40 ma. for 7 minutes.

November 1st, 40 ma. 3d, 40 ma. 5th, 35 ma. 7th, 35 ma. 9th, 40 ma. for 5 minutes each. 11th, 50 ma. 14th, 60 ma. for

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7 minutes each. Is sleeping very much better, and the appetite is much improved. 23d, 60 ma. for 5 minutes. The period is over, and has been much as usual, except that there was little swelling of the tumor. 25th, 60 ma. 28th, 90 ma. for 5 minutes each. Gaiffe's galvanometer was used to-day.

December 12th, 100 ma. 14th, 110 ma. 16th, 110 ma. 26th, 115 ma. for 5 minutes each. There is no longer any trouble with the bladder, and the lady is able to get about better and can get up-stairs more easily. 28th, 150 ma. for 5 minutes.

January 7th, 1888, 110 ma. 9th, 100 ma. for 5 minutes each. A puncture was not made to-day, the sound being passed into the uterine cavity instead. Says she feels as if she could fly. 11th, 110 ma. 24th, 150 ma. for 5 minutes each. The applications are decidedly easier when a puncture is not made. The period has been much as usual. 26th, 150 ma. 21st, 170 ma. 31st, 180 ma. for 8 minutes each.

February 2d and 18th, 180 ma. for 8 minutes. There has been rather more discharge, but the patient feels very well. 21st, 180 ma. for 8 minutes. 23d, 190 ma. for 10 minutes. 25th, 180 ma. for 8 minutes. 28th, 180 ma. for 10 minutes.

March 1st, 175 ma. 3d, 195 ma. for 10 minutes each. 6th, 200 ma. for 8 minutes. 8th, 250 ma. 17th, 150 ma. for 10 minutes each. The period has been much as usual. 20th, 200 ma. 22d, 200 ma. 24th, 160 ma. 27th, 180 ma. 30th, 170 ma. for 10 minutes each.

April 1st, 110 ma. for 8 minutes. The lady is very well, and the tumor is about half the size it was before.

Dr. Nicholls wrote on 30th April, "Mrs. —— wishes me to write and let you know how much she has improved. The tumor is much less, and she can walk with comfort."

June 25th, 1889.—"She has certainly derived permanent benefit from the electric treatment, but has been ill with bronchitis lately. The left fibroid tumor is doing well; but some time back there was a fresh formation in the right side, which I thought might require your treatment. You will be pleased to hear this is now better."

Case XLVIII.—Married, age 37; was brought to Edinburgh by her husband, who is a doctor, in October, 1887.

For several years this patient has not been in very good health, and the monthly periods are lasting longer and the quantity of discharge is steadily increasing. Fifteen months

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ago, the tumor was first noticed, and it has grown with considerable rapidity, and now its weight is beginning to be a very serious matter, as it prevents her getting about. In the summer-time the lady became pregnant, and it was thought advisable to get rid of the fœtus. Life is beginning to be a burden, and the care of her house and of her children is a great source of fatigue.

The tumor is found to be of some considerable size. It extends upward to fully 2 inches above the umbilicus, and passes well into both loins. The cavity is toward the right side, and a sound passes without difficulty to a depth of 9 inches.

Naturally, the husband was very anxious, as the tumor had evidently opened up both broad ligaments, and as the lady was not very strong. Although he knew, of course, that Apostoli's treatment was not of very old standing, yet anything seemed to be better than the risk of hysterectomy.

The treatment consisted in nineteen sittings, the internal electrode being made negative on every occasion. The reason why there were not more was because the patient became anxious to get home for Christmas; and after getting home, she preferred to wait and see what would be the result before commencing again.

October 25th, 40 ma. 27th, 80 ma. 29th, 100 ma. for 5 minutes each.

November 1st, 100 ma. for 5 minutes. Already there is an appreciable difference in the size of the tumor. 3d and 5th, 100 ma. for 5 minutes. 12th, 100 ma. for 7½ minutes. The period is over. There was less discharge than for some time, and the patient does not feel so exhausted as usual. 15th, 17th, and 19th, 100 ma. for 5 minutes. The tumor is slowly diminishing in size, and the patient feels stronger. 22d and 24th, 100 ma. for 5 minutes. 26th, 140 ma. for 5 minutes. Gaiffe's galvanometer was used to-day for the first time.

December 1st, 120 ma. 3d, 210 ma. for 5 minutes each. There is a marked lessening in the size of the tumor. 10th, 180 ma. for 5 minutes. A fairly easy period is over. 13th, 225 ma. for 5 minutes. 15th, 115 ma. for 8 minutes. 17th, 230 ma. for 10 minutes. There is a decided improvement in every respect.

Extracts from husband's letters:

January 24th, 1888.—"It is now a month since my wife re-

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turned from Edinburgh, and time for me to report progress. So far as size of tumor goes, I think that it is less than when you saw her last—not much, but decidedly on the left side. One period has passed, fairly moderate, but followed, as before, by a pretty steady discharge of a chocolate color. She has complained much of the left iliac pain—not constantly, but very severe for hours at a time; if anything, less often within the last ten days. Her strength is very far from satisfactory; in fact, she has been able to be out very seldom."

October 27th, 1888.—"It is now six months since last I wrote to you about my wife's case, and I am anxious to let you know how things have gone. You may remember that then she was having periodic attacks of pelvic pain with raised temperature and a constant brownish discharge from the uterus, usually small in amount, with, at times, great uterine tenesmus and the discharge of large clots. This went on till the end of May, when there was to be felt on the right side a boarding condition of the abdominal wall up to the level of the umbilicus—in fact, the tumor on that side seemed to be glued into the pelvis and covered with the lymph resulting from these attacks of cellulitis. On the left side the tumor seemed less. Her general condition was very bad. She was very anæmic, and as thin as a whipping-post, and you would have given very little for her chance of recovery. Early in June I removed her carefully to Stonehaven, her native air, and she seemed to pick up from that time on. She had only one attack soon after going there, and since then her recovery has been steady and satisfactory. I simply trusted to rest and change as you suggested. May, June, and July, there was no period and no discharge of any kind; August, a mere show; September and October, a very moderate and painless, and, in fact, perfectly natural period. She stayed three and a half months in Stonehaven, and now, since she came home, she feels and looks perfectly well; excellent appetite, and no discomfort of any kind. She has evidently run the gauntlet of severe cellulitis to what is apparently a perfect cure—*i.e.*, she would not know she had or ever had a tumor. The physical examination of the abdomen reveals the tumor very much less in every direction—hardly to be felt on left, and the effused lymph absorbed entirely, so far as palpation can make out. She herself swears by electricity."

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CASE XLIX.—Married, age 45; was sent by Dr. Dunsmure.

This patient, who was terribly anæmic, had known of the presence of a tumor for seven or eight years. For eight years there have been severe bleedings—so severe, indeed, that it has on several occasions seemed as if she would die from loss of blood. Her mother says that she has counted as many as one hundred and twenty napkins. The periods last for two weeks, and there is an interval of one week, sometimes two. She is, as might be expected, very weak, and is so breathless that she can scarcely walk. Some years ago a sloughing submucous tumor came away, and there was slight improvement for a short time afterward.

The tumor is very large and prominent. It extends up under the ribs. The sound enters for at least 9 inches; curiosity ceased at this distance. For the treatment of a tumor bleeding as this one was doing, it was evident that the positive pole would have to be attached to the sound.

October 25th, 1887, 35 ma. 27th, 80 ma. 29th, 100 ma. for 5 minutes each.

November 1st, 100 ma. 3b, 100 ma. for 5 minutes each. The tumor is slightly movable. 17th, 80 ma. for 5 minutes. There has been a good quantity of blood lost at the period, though it lasted but seven days. 19th, 22d, and 24th, 80 ma. for 5 minutes. 29th, 100 ma. for 5 minutes. Gaiffe's galvanometer was used to-day.

December 1st, 90 ma. 13th, 140 ma. for 5 minutes each. The period has been much the same as the last. The interval was, however, longer than usual. 15th, 140 ma. 17th, 150 ma. for 5 minutes each. 20th, 100 ma. 22d, 140 ma. for 8 minutes each. 24th, 170 ma. for 5 minutes. 27th, 210 ma. 29th, 230 ma. for 8 minutes each.

January 12th, 1888, 210 ma. for 5 minutes. There has been less discharge than for a long time; and although the flow continued for eleven days, the bleeding ceased nearly every day for several hours. 14th, 250 ma. 17th, 200 ma. 19th, 200 ma. 21st, 200 ma. 24th, 216 ma. 26th, 160 ma. for 5 minutes each.

There is slight improvement, and the tumor does not now extend upward under the ribs on the right side. There was a severe hemorrhage after this, and the treatment was, on account of other reasons, not resumed before we left Edinburgh.

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In September there appeared to be some decided improvement; there was less discharge, and the lady was able to take her food better, and there was not any sickness.

January 19th, 1889.—The patient is a little better than she was a year ago, and the treatment has at least prevented her getting worse for the last twelve months. She intends, if possible, to come up to London, and by continuing the treatment in her own bed, the progress will be more rapid than when she had to drive more than four miles for each application.

May, 1889.—This lady's mother says that she finds a very decided improvement both in the general health and in the quantity of blood lost. A sister was much surprised to find that she was able to walk from the cab into the house, as when she had seen her last, two years before, the patient had to be carried everywhere. The tumor has diminished in a wonderful manner since the treatment was stopped more than a year ago, and it is now not more than half the size it was. It is up to the ribs on the left side, and a hand's-breadth below them on the right, and is freely movable. The abdominal wall is quite fat, and the skin can be pinched up, instead of being tightly stretched over the tumor.

May 13th, 130 ma. 15th, 140 ma. 17th, 130 ma. 20th, 140 ma. for 5 minutes each. The period is due to-day, though since the treatment last year it sometimes does not appear for seventeen, or even eighteen days. 22d, 135 ma. 27th, 130 ma. 29th, 140 ma. for 5 minutes each. The period came on yesterday, eight days late. 31st, 135 ma. for 5 minutes.

June 3d, 140 ma. 5th, 120 ma. for 5 minutes each. This has been the least bad period for a very long time, and the lady was confined for only six days. 7th, 135 ma. 10th, 150 ma. 12th, 150 ma. 14th, 170 ma. for 5 minutes each. The tumor is decreasing with great rapidity, and the patient walks about the house more easily. 17th, 160 ma. 19th, 165 ma. for 5 minutes each. The patient has been outside for a walk. Two years ago she had to be carried on account of breathlessness. 21st, 200 ma. 24th, 150 ma. 26th, 205 ma. 28th, 230 ma. for 5 minutes each. The period is commencing to-day. During the past week the lady has walked more than she has done for five years.

July 1st, 230 ma. 3d, 200 ma. 5th, 240 ma. 9th, 250 ma. for 5 minutes each. The loss has been comparatively slight.

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CASE L.—Single, age 36; was sent into the Royal Infirmary, Edinburgh, in October, 1887, by Mr. Imlach.

In January of the same year this patient was operated on at the Samaritan Free Hospital, for the purpose of curing the symptoms due to the presence of a fibroid tumor of the uterus. The operation was evidently removal of the ovaries, and the name of the hospital where it was performed is a sufficient guarantee that it was properly done. From the woman's history, there can be no doubt but that the operation was most certainly justifiable at that time, though now, she might have been cured more certainly and more quickly without having the abdomen opened. It is probable that there was some difficulty experienced in reaching the ovaries, as the cicatrix was of extraordinary length for such an operation.

The patient made a good recovery, and there was not any bleeding for two months. It was not very bad at that time. The flow came on again in April and in May, but in June there was what is described to have been a severe flooding. Medicine was prescribed at the Samaritan Hospital, and the bleeding ceased after this had been taken for ten days. The flooding again returned in the beginning of August, and lasted for the whole of the month. This debilitated her so much that she was unable to follow her employment, that of a lady's maid. In September and October there has been more or less bleeding almost every day, and the woman is now very breathless and anæmic.

The tumor extends to midway between the pubes and umbilicus, is very irregular, and there is a mass pressing down on the bladder. The patient is not very sure whether the growth is smaller or not since the operation, and, as she is not any better, is naturally disappointed. There is great difficulty in getting a sound into the uterine cavity, but it can be passed to a depth of rather more than 4 inches.

October 25th, 1887, 60 ma. 27th, 80 ma. 29th, 70 ma. for 5 minutes each.

November 1st, 80 ma. 3d, 120 ma. for 5 minutes each. The patient thinks that she feels a little better. 8th, 120 ma. 10th, 80 ma. 15th, 85 ma. for 5 minutes each. There has not been any bleeding since yesterday, and she really feels stronger, and can walk better. 17th, 85 ma. 19th, 90 ma. for 5 minutes each. The tumor is not pressing so much on the bladder to-

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day, and there is consequently less discomfort. 22d, 95 ma. 24th, 85 ma. 26th, 100 ma. for 5 minutes each. Gaiffe's galvanometer was used to-day. There is steady improvement generally, and less bleeding. 29th, 120 ma. for 5 minutes.

December 1st, 130 ma. 3d, 110 ma. 6th, 100 ma. 8th, 170 ma. 10th, 135 ma. 13th, 175 ma. 15th, 200 ma. 17th, 165 ma. 20th, 175 ma. for 5 minutes each. Improvement is steady, and the tumor is becoming smaller. Up till and including to-day the applications have been positive. 22d, 170 ma. 24th, 140 ma. 26th, 120 ma. for 5 minutes each. The sound in the cavity has been attached to the negative pole of the battery at the last three sittings, but the bleeding has recommenced. 28th, 145 ma. for 5 minutes. A return was made to-day to the positive applications. as the bleeding had increased. 30th, 180 ma. for 5 minutes.

January 5th, 1888, 150 ma. 7th, 180 ma. 12th, 150 ma. 14th, 175 ma. for 5 minutes each. There is a very marked difference in the size of the tumor. The patient feels well. 17th, 160 ma. 19th, 220 ma. 21st, 210 ma. 24th, 230 ma. 26th, 180 ma. 28th, 200 ma. 31st, 205 ma. for 5 minutes each.

February 2d, 200 ma. 4th, 180 ma. 7th, 185 ma. for 5 minutes each. There is now little tumor; the irregular and to a certain extent pediculated growths have almost entirely disappeared. 9th, 200 ma. 11th, 210 ma. 16th, 200 ma. 18th, 220 ma. 21st, 210 ma. for 5 minutes each. Says that she feels splendidly well. The cavity measures 3¾ inches. 23d, 190 ma. 25th, 200 ma. 28th, 200 ma. for 5 minutes each.

March 1st, 185 ma. 3d, 220 ma. 6th, 235 ma. for 5 minutes each. Says that she now feels quite well.

In May she was in a situation, and was perfectly well.

March 19th, 1889.—There are still attacks of bleeding at times, though never very severe. The patient has been in a situation and able to do her work since she left Edinburgh. She is not anæmic, and the tumor is found to be smaller than it was a year ago.

June 6th.—"I am much better than when I saw you last."

July 4th.—There has not been any discharge for three months, and the patient looks and says that she feels perfectly well.

CASE LI.—Married, age 37; came to Edinburgh in October, 1887, for the electrical treatment.

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The illness has been of long standing—there having been profuse menorrhagia for many years, and the presence of a tumor was noted some eight or ten years ago. She was seen at her home in Newcastle some years ago, and at that time was very ill. There was phlegmasia dolens of both legs, and there were emboli in the lungs. She was at this time in bed for eight months. After this illness there was some improvement in the general health. The tumor is growing steadily. The present condition of the patient is, that she suffers much from the size of the tumor and from the pressure it gives rise to, and the lady is almost entirely unable to walk.

The abdomen is enormously distended by a tumor which must weigh at least thirty pounds; the ribs and sternum are raised all round, and the mass is quite immovable. The sound passes to a depth of 9 inches, and does not then reach to the top of the cavity.

This was a case where it would have been very advisable to treat the patient in her own bed, but we did not then have suitable apparatus for that purpose. She could not walk nor drive, so had to be brought in a Bath chair.

October 29th, 1887, 40 ma. 31st, 35 ma. for 5 minutes each. There has been pain in the back since the first application.

November 2d and 4th, 40 ma. for 5 minutes. The patient feels stronger already. 7th, 50 ma. 9th, 80 ma. 11th, 85 ma. for 5 minutes each. The tumor is looser, and the patient did not feel tired after the last application. 14th and 16th, 80 ma. for 5 minutes. Is walking better, and can go up-stairs more easily. 18th, 80 ma. 26th, 30 ma. for 5 minutes each. There has been more flow than usual. Gaiffe's galvanometer was used for the first time. 28th, 80 ma. 30th, 100 ma. for 5 minutes each.

December 1st, 110 ma. for 5 minutes. Is stronger, and walked a quarter of a mile to-day. 3d and 5th, 110 ma. for 5 minutes. 7th, 125 ma. 9th, 150 ma. for 5 minutes each. 12th, 200 ma. for 8 minutes. 14th, 210 ma. for 5 minutes. 16th, 210 ma. for 10 minutes. The tumor is slowly decreasing in size. 26th, 220 ma. for 10 minutes. Again a bad period. The tumor is to-day smaller than it has been for many years. 28th, 175 ma. 30th, 230 ma. for 10 minutes each.

January 2d, 1888, 250 ma. for 10 minutes. The lady's dresses are all too loose. 4th, 180 ma. 6th, 180 ma. 9th, 250 ma. 20th,

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185 ma. for 10 minutes each. Another bad period, accompanied by pain. Though the general condition and appearance have much improved, the lady has lost seven pounds in weight since the treatment was begun. She is much pleased with her appearance. 23d, 200 ma. 25th, 220 ma. for 10 minutes each. She had a dress taken in 2 inches. 26th, 200 ma. for 10 minutes. Is to go home for a time and see how she gets on. The tumor is now so freely movable, that it is an annoyance when she turns round in bed. The sound was always made negative.

February 2d.—"You will have heard from Dr. Hume how pleased he was to find me so much better: so most of the friends I have seen think. They see a great change in my figure."

In July she sent a friend with a large fibroid; but as menstruation had ceased, and she had begun to improve, treatment was not advised.

July 25th.—"I am a great deal better and stronger since I was with you last winter, and have never felt the same inconvenience in breathing that I used to have. The tumor went lower down when with you, and has kept there; but, as you know, it is a large one yet, and a great burden to me; also I have just as much discharge as ever."

The lady came back in October, 1888, to try and have the tumor further reduced in size, and also with the hope of being cured of the necessity of having to go to bed for three days every month. The tumor had become smaller since January, and the lady looked very well. She felt so well also that she proposed to stay with friends at Streatham, and come in three times a week for the treatment. Ordinary persons require to allow themselves seven minutes to walk to the station, but at first Mrs. —— had to give from fifteen to twenty minutes.

Half an inch of sound was exposed in the cavity of the uterus, and was made positive.

October 9th, 100 ma. 11th, 125 ma. 13th, 135 ma. 15th, 135 ma. 17th, 135 ma. 19th, 140 ma. 21st, 155 ma. 24th, 155 ma. for 5 minutes each. Certainly the tumor is smaller.

November 2d, 135 ma. for 5 minutes. Not a good period, but looks well. 3d, 130 ma. 7th, 135 ma. for 5 minutes each. Feels that she can walk more lightly. 10th, 145 ma. 12th, 165 ma. for 5 minutes each. The lady had a busy day to-day.

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She left home about half-past ten, arrived at Charles Street about half-past eleven; had the application, rested, and then met a party, composed chiefly of children, and had lunch. After lunch they went to see an afternoon performance of the "Armada" at Drury Lane, and did not get home until nearly seven o'clock. 14th, 175 ma. for 5 minutes. 16th, 19th, 21st, and 28th, 150 ma. for 5 minutes. As much discharge as usual; but feels better and stronger.

December 1st, 140 ma. 3d, 150 ma. 5th, 135 ma. 7th, 150 ma. 10th, 150 ma. 12th, 150 ma. for 5 minutes each. Is very well, and can walk to the station in seven minutes like other people.

February 22d, 1889.—The lady's husband wrote: "I am happy to say she continues better, and is able to walk about and see her friends. She considers that she has profited very much by your treatment, and looks forward to still greater progress toward convalescence as the year advances."

June 27th.—"I am very much better in health, and every one tells me that I have lost that suffering look they say I had. I can walk much farther and quicker, and am altogether nothing like such a burden to myself. The tumor is a good deal less than even when I saw you last (but still it is large). It is lower down, so does not interfere with my breathing."

CASE LII.—Married, age 51; no family.

The patient said, that for fully a year, she had had a constant and profuse discharge, which was usually more or less bloody. It had begun gradually; at first the regular periods being prolonged, and there was a thick yellowish discharge in the intervals. Gradually the "red" and the "white" became merged together, and the patient was unable to tell whether there were any menstrual flow or not. The general health had naturally been seriously affected, and the lady was thin, nervous, and miserable.

Twelve months before, a diagnosis of malignant disease had been made.

The uterus was found to be large, soft, and to lie very much forward, and the sound showed that the length of its cavity was 4 inches.

As there did not appear to be sufficient evidence to justify the diagnosis of malignant disease, the patient was advised to try what electricity could do for her relief. She did not

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bear the current well. The internal electrode of platinum was attached to the positive pole.

October 29th, 1887, 40 ma. for 5 minutes.

November 1st, 80 ma. 3d, 80 ma. 5th, 120 ma. for 5 minutes each. For the first time for a year there had not been any discharge for twenty-four hours. 8th, 100 ma. for 5 minutes. The discharge has begun again, and the patient does not feel as well as she did a couple of days ago. 10th, 100 ma. 12th, 80 ma. 15th, 80 ma. 17th, 40 ma. for 5 minutes each. The discharge is more viscid to-day. 19th, 60 ma. 22d, 60 ma. 29th, 90 ma. for 5 minutes each. Gaiffe's galvanometer was used to-day. There is rather less discharge, and the lady feels somewhat stronger.

December 1st, 70 ma. 3d, 80 ma. for 5 minutes each. There is less discharge, and the patient is feeling decidedly better and has more strength. 8th, 75 ma. 10th, 100 ma. for 5 minutes each.

The discharge continues to diminish in quantity, and as the patient feels that she is steadily gaining ground, she wishes to stop treatment, which has been, on account of her nervous state, rather a trial to her.

The subsequent history we have been unable to learn. We had neither taken her name nor address.

CASE LIII.—Married, age 32; came to Edinburgh in November, 1887.

Patient was married a year ago, and about the same time a lump, which is steadily increasing in size, was noticed in the abdomen. Menstruation began at the age of 14, and has been always profuse and painful. Of late years there has been decided improvement in the amount of pain, but the quantity of discharge is increasing, and large clots are passed. It is only lately that the menorrhagia has begun to affect the general health.

On examination, the tumor is found to be prominent and to extend up to the umbilicus. The cavity is very wide, and the sound enters to a depth of 8½ inches.

Eighteen negative applications were made.

November 1st, 1887, 60 ma. 3d, 50 ma. 5th, 70 ma. 8th, 80 ma. 10th, 70 ma. 12th, 80 ma. 15th, 80 ma. for 5 minutes each. There is little difference in the size of the tumor, but the patient thinks that she feels somewhat better. 17th, 80

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ma. 19th, 120 ma. 26th, 150 ma. for 5 minutes each. There has been much less hemorrhage this time, and only two clots. The patient feels much better than usual. Gaiffe's galvanometer used. 29th, 160 ma. for 5 minutes.

December 1st, 140 ma. 3d, 150 ma. 6th, 70 ma. for 5 minutes each. There has been some pain in the tumor, and the current was not well borne to-day. 8th, 100 ma. for 5 minutes. The pain is gone. 10th, 175 ma. 13th, 175 ma. 15th, 200 ma. for 5 minutes each. Patient has to go home in the mean time. The pain is quite gone, and she feels very well. The tumor is smaller, but not markedly so.

CASE LIV.—Married, age 34; was seen with Dr. Scott, of Musselburgh, in November, 1887

The lady has not felt well for a number of years, and has suffered much from menorrhagia, from constant pain in the back, and from difficulty in walking; symptoms severe enough to prevent her having much pleasure in her existence.

On examination it was found that the pelvis was filled with a fibroid tumor of the uterus. Twenty-six positive applications were made.

November 8th, 40 ma. 10th, 40 ma. 12th, 80 ma. 15th, 80 ma. 17th, 80 ma. 19th, 80 ma. 22d, 60 ma. 24th, 80 ma. for 5 minutes each.

December 1st, 80 ma. for 5 minutes. The period is over; there was more discharge, and the pain was more aggravated than usual. 3d, 100 ma. 5th, 80 ma. 8th, 85 ma. 10th, 95 ma. 13th, 100 ma. 15th, 100 ma. 17th, 110 ma. for 5 minutes each. There is now decidedly less pain in the back, and the lady can walk better. 20th, 135 ma. 27th, 110 ma. for 5 minutes each. The period is over; there has been a marked improvement, both in the quantity of discharge and in the amount of pain. 29th, 110 ma. 31st, 120 ma. for 5 minutes each.

January 3d, 1888, 120 ma. 5th, 125 ma. for 5 minutes each. There is almost no pain, and in every respect the patient feels that there is a great improvement. 7th, 130 ma. 10th, 110 ma. for 5 minutes each. The patient has been going about a great deal, she says, and there has been more of the backache. 12th, 130 ma. for 5 minutes. The patient is again much better. 14th, 125 ma. for 5 minutes.

On February 5th, 1889, Dr. Scott writes, "She is fairly well,

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the fibroid has remained quiescent, and there has been no hemorrhage since you kindly treated her."

CASE LV.—Married, age 28; came to the Woman's Dispensary, Edinburgh, for the electrical treatment in November, 1887.

This patient had never been strong, and had suffered from dysmenorrhœa all her menstrual life—the pain being worst on the third day. Some two years before, she had been admitted into the ward of one of the obstetric physicians of the Edinburgh Royal Infirmary, on account of floodings. While in the ward she was pressed to allow the removal of the ovaries; but a sister, whose ovaries had been removed some years before, persuaded her to go home for a time. She was then admitted into the special ward for the treatment of ovarian disease in the infirmary. The patient was much emaciated, and no palpable disease of the ovaries or uterus could be detected; but as there was a copious discharge of blood from the bowel she was sent to the medical house; after a few weeks she quickly recovered and was discharged. After that time I saw her once or twice. She kept fairly well, and month by month the menstrual loss became less, until June, 1887, when she again began to lose too much. There began to be also a constant feeling of weight and pressure on the bladder, and the health began to fail. When I saw her in October there was a swelling attached to the right side of the uterus, falling forward and pressing on the bladder, the size of a small hen's egg. It was so exquisitely tender that one would have been inclined to think that it was an enlarged and inflamed ovary, had it not been possible to feel both those glands. On account of the general debility, and more especially from the great tenderness, I was loth at first to try electricity for fear that the simple passage of the sound might do harm; but after using hot water and glycerin pads with absolutely no improvement, I thought it best to attempt cure by this means before advising operation. The pain on passing water was said to be excruciating, and often lasted for hours. From her appearance there could be no doubt that she was a great sufferer. The treatment was begun on the 9th November, 1887. At that date the uterus was large, and pushed upward and toward the left by a tender mass on the right side connected with the fundus, about the size of a flattened-out cricket ball.

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The upper margin was 4 inches above the pubes. The uterine cavity measured 3½ inches. The sound was connected to the positive pole, and on the 9th, 11th, 14th, and 18th November a current of about 40 ma. was allowed to flow for 3 minutes. The period came on after these four applications. There was more flow and more pain.

November 28th, 40 ma. for 4 minutes.

December 2d, 45 ma. for 4 minutes.

February 1st, 50 ma. for 4 minutes. 6th, 50 ma. 10th, 60 ma. 13th, 45 ma. 17th, 45 ma. 20th, 40 ma. 22d, 50 ma. for 5 minutes each. Although there has been and still is a great deal of pain, it is slowly becoming less. The tumor is smaller and more easily handled. 24th, 65 ma. for 5 minutes.

March 2d, 60 ma. for 5 minutes. For a few days before the period, which is just over, there was very decidedly less pain; but during the flow the pressure on the bladder was said to be "terrible." 5th, 60 ma. 7th, 70 ma. 9th, 80 ma. 12th, 75 ma. 14th, 40 ma. for 5 minutes each. For the first time for many months she was entirely free from pain all day yesterday. The tumor is not half the size it was. 19th, 50 ma. 21st, 40 ma. 23d, 100 ma. 26th, 100 ma. 28th, 100 ma. 30th, 110 ma. 31st, 85 ma. for 5 minutes each.

April 4th, 55 ma. for 5 minutes. The period is over. There has hardly been any of the bladder pain which was so bad last time. A natural period as regards quantity. 5th, 100 ma. 6th, 110 ma. for 5 minutes each.

In all, thirty applications, the positive electrode being always in the uterine cavity.

There was little tumor remaining; there was little pain; there was not any menorrhagia; and there was marked improvement in the general health and spirits.

In September we heard, through a sister, that the patient had left Edinburgh, but had been very much better, and had simply a little pain every month.

CASE LVI.—Married, age 42; came to the Woman's Dispensary, Edinburgh, on November 11th, 1887.

She had enjoyed the best of health until her sixth and last child was born, seven years before. The labor had been easy, nor had there been any difficulty on the five previous occasions. For those seven years she has been "ill altogether," and suffered from constant and severe pain in the back and

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left side, aggravated every month at the time of the periods. Two years ago she first noticed a lump in the abdomen, but in spite of this she had undergone a variety of treatment for displacement, no one apparently putting his hand on the abdomen until she was seen by Dr. Richardson, who sent her to the dispensary.

Her greatest distress, at the present time, is caused by irritability of the bladder, so great that she is never comfortable for two minutes together. For months she has been up at nights never less often than five times, and during the day is unable to retain more than a tablespoonful of urine at one time. The act of micturition is also accompanied by a very considerable amount of pain. In addition to this most distressing symptom, there is constant pain in the back and sides, and difficulty in walking, due to a terrible feeling of weight and dragging in the pelvis. Latterly the loss of blood every month has been considerable. She is totally unable to take care of her husband, her children, or her house, and has become nervous, irritable, and low-spirited. Fifteen months after this date, when she was well, she told me that she used to become so melancholic before the periods that she felt afraid that she might some day do away with herself. The poor woman has also been unable to sit in a chair for a long time. She looked utterly miserable and depressed.

On examining the abdomen, a mass rising out of the pelvis and extending to within two inches of the umbilicus was felt with the greatest ease, as the abdominal wall was much emaciated. The cervix was found to be somewhat in front of its natural position, and to be connected with the tumor which had been felt in the abdomen. Posteriorly, the pelvis was filled with another fibroid growth, which distended the posterior fornix. This explains the displacement theory—although the direction of the cervix, etc., showed that the body of the uterus did not lie backward even before the sound had been passed. The uterine cavity measured rather more than 5 inches, and could be measured without any difficulty.

Treatment.—The mass posterior to the cervix was punctured to the depth of nearly half an inch with an insulated steel needle the thickness of a No. 2 catheter (English scale). This was done on the 11th, 14th, and 21st November, and a current of electricity of probably from about 60 to 120 ma.

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was passed from the abdomen for five minutes. The result of even the first of these applications was almost magical, for at her second visit on the 14th she looked marvellously better; she had lost a great deal of her worn and irritable expression; she had been able to sit on a chair without pain; she had been up but once every night, and coul i hold her water until the bladder contained a cupful during the day, and then empty it without pain or discomfort. Really the difference this one application made it is impossible to express, and hardly possible to believe, yet there appeared to be no difference in the physical condition. She menstruated after the second application with much greater comfort.

On the 25th and 28th of the month currents of 120 and 105 ma. were passed as before, except that no puncture was made, the internal electrode being the sound inside the uterine cavity.

December 2d, 130 ma. 5th, 120 ma. 9th, 110 ma. 16th, 75 ma. for 5 minutes each. Puncture was again made to-day. Both in the abdomen and also in the pelvis it was found that there was a marked diminution in the size of the growths.

January 6th, 1888, 110 ma. 13th, 125 ma. 16th, 155 ma. 20th, 130 ma. 25th, 155 ma. 27th, 145 ma. for 5 minutes each. The improvement during the month has been entirely satisfactory. She now sleeps all night without wakening. On pressing deeply in the abdomen no tumor can now be felt, and the uterine cavity measures 3 inches.

February 6th, 160 ma. 10th, 150 ma. 13th, 150 ma. 17th, 185 ma. 20th, 155 ma. 24th, 170 ma. for 5 minutes each. Feels always at her best on the day that she has treatment. The amount of blood lost at the period has been less.

March 2d, 80 ma. 5th, 220 ma. 9th, 125 ma. 12th, 130 ma. for 5 minutes each. For the last few days there has again been frequent desire to micturate, with discomfort, and accompanied by the presence of urates in the water. 19th, 160 ma. 21st, 150 ma. for 5 minutes each.

April 2d, 170 ma. for 5 minutes. On account of the bladder irritation, the positive pole was placed in the uterus, and the urethra was slightly dilated with a bougie on one occasion. 4th, 140 ma. 6th, 150 ma. for 5 minutes each.

A return was made to the negative pole in the uterus. The patient now feels almost quite well; there is very little pain, no bladder irritation, no sleeplessness; little difficulty in walk-

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ing, and she can do and has been doing all her housework for the last two months.

Thirty applications in all were made. In twenty-three the internal pole was the negative sound in the uterine cavity, in four the negative needle in the tumor, and in three the positive sound in the cavity.

The local result was, that the uterus had returned to its natural size, and that there was a pediculated fibroid mass in the pouch of Douglas, not half as large as it had been before.

Condition on January 19th, 1889, nine and a half months after the last application. In a word, she is quite well, she has no pain, no difficulty in sitting nor in walking, no trouble with the bladder, and can pass water as well as she ever did in her life. There is not any menorrhagia, and the melancholic condition has disappeared. Occasionally there is a little headache. She said to me, "I was just thinking to-day how well I am. You don't know what you have done for me; I am in a different world altogether, and can do everything for myself."

CASE LVII.—Married; was sent to Edinburgh by Dr. Napier, of Glasgow, in November, 1887.

The patient had been married for fourteen years, and had not had any family. She had enjoyed very good health until about fifteen months ago, when, on account of increased loss at the menstrual period, she was examined by Dr. Napier, who felt the tumor. Though this was growing rapidly, and the menorrhagia, accompanied by pain, was increasing, the patient would not have any but ordinary treatment, until she became alarmed by an attack of peritonitis, which confined her to bed for three weeks. On her recovery she came through to Edinburgh. The tumor extended upward to the level of the umbilicus.

Thirty negative applications were made in twelve weeks.

November 15th, 1887, 40 ma. 17th, 65 ma. 19th, 80 ma. for 5 minutes each. The tumor has begun to diminish in size. 22d, 85 ma. 24th, 90 ma. 26th, 115 ma. for 5 minutes each. The patient does not feel very comfortable to-day. Gaiffe's galvanometer was used. 29th, 75 ma. for 5 minutes.

December 6th, 85 ma. for 5 minutes. The menstrual flow is over; there has been more discharge than usual and less pain. 8th, 100 ma. 10th, 100 ma. 13th, 120 ma. 15th, 135 ma. 17th, 100 ma. for 5 minutes each. There is some pain in

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the tumor to-day; not severe enough to prevent the patient coming for treatment. 20th, 135 ma. for 5 minutes. The pain, which was complained of three days ago, was dissipated by the passage of the current. 22d, 140 ma. 24th, 120 ma. for 5 minutes each.

January 3d, 1888, 110 ma. for 5 minutes. The patient has been home for Christmas, and while there had a very satisfactory period. 5th, 115 ma. 7th, 145 ma. 10th, 125 ma. 12th, 150 ma. for 5 minutes each. The tumor is very much smaller, is quite movable from side to side, and the abdomen is now quite flat. 14th, 100 ma. 17th, 150 ma. 19th, 135 ma. 28th, 125 ma. for 5 minutes each. There has been rather more discharge than at the last period. The patient feels well. 31st, 135 ma. for 5 minutes.

February 2d, 135 ma. 4th, 145 ma. 7th, 130 ma. 9th, 130 ma. for 5 minutes each.

The tumor is not half the size it was; instead of filling the lower half of the abdomen, it can now be felt with some little difficulty as a loose, movable body.

September.—Heard that the patient was very well, and that the tumor had got smaller since she was last seen in February.

CASE LVIII.—Married, age 33; was sent into the Royal Infirmary, Edinburgh, by Dr. Morgan, of Sunderland, in May, 1886.

The patient had been suffering for the past five years from the effects of excessive losses of blood at the monthly periods. For the same length of time she had been aware of the presence of a tumor in the abdomen.

On examination, the tumor was found to extend to midway between the pubes and the umbilicus, and to be situated rather more on the left than on the right side. The pelvis was packed with the mass, which extended on both sides to the pelvic wall, and filled up the entire hollow of the sacrum. It was evident that the tumor itself could not be removed, so it was agreed to take away the ovaries, if possible. The left one was to be felt high up on the side of the tumor. On the right side there was a tender spot, but no trace of ovary could be found.

The operation was performed on the 24th May in the presence of Dr. Morgan, Dr. Price, of Philadelphia, Dr. Hodsdon,

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and others. There was a layer of 1 inch of fat on the abdominal wall. The omentum was found to be spread out over the tumor, and to be adherent to it, and with some difficulty the left ovary was got hold of. The incision was enlarged, and it was drawn well into view. The ovary appeared to be fairly healthy, and the tube was dilated to about the size of one's thumb. The broad ligament was transfixed as close to the uterus as possible, tied, and the parts removed. The right ovary was found to be situated deeply in the pelvis inclosed in the layers of the broad ligament. By drawing up the tumor and then throwing the light into the pelvis by means of the reflector, it was seen where the ovary was. Running over it toward the bladder, which was drawn up and displaced to the right side, the ureter was detected. Under the circumstances it was thought best to make no attempt at removal. The patient went home in three weeks.

November, 1887.—The patient has come back for the electrical treatment. At first, after the operation, there was a decided improvement, but for some months she has had severe losses of blood, lasting for a week, and recurring after another week's interval. She is now more anæmic and weak than she was before the operation in 1886. The tumor is both larger and harder, and reaches up to the level of the umbilicus. A sound passes 6½ inches.

The treatment consisted in thirty-six positive applications.

November 15th, 35 ma. 17th, 40 ma. 19th, 65 ma. 24th, 65 ma. for 5 minutes each. The period has been much as usual, except that it was one day shorter, and she was in bed for four days only. 26th, 125 ma. for 5 minutes. Gaiffe's galvanometer was used to-day. 29th, 110 ma. for 5 minutes.

December 1st, 125 ma. 3d, 150 ma. 6th, 175 ma. 13th, 165 ma. for 5 minutes each. The period has not been any worse than the last one. The interval was twelve days, a gain of five. 15th, 220 ma. 17th, 160 ma. 20th, 200 ma. 22d, 200 ma. 24th, 125 ma. 28th, 160 ma. for 5 minutes each. The patient's husband has been to see her, and says that he notices a great difference in her strength and appearance. 30th, 160 ma. for 5 minutes.

January 12th, 1888, 200 ma. for 5 minutes. After an interval of eighteen days, the third period since the treatment

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was begun came, and was very much the same as the last two. 14th, 155 ma. 17th, 140 ma. 19th, 165 ma. 21st, 165 ma. 24th, 170 ma. 26th, 175 ma. 28th, 175 ma. for 5 minutes each.

February 4th, 170 ma. for 5 minutes. There was a marked improvement in the menstrual flow this time. The interval was two days shorter than the previous one; but the quantity of discharge was very much less, and the patient had to keep in bed for only one day. The tumor is more movable, and its upper line is an inch below what it was. 7th, 130 ma. 9th, 175 ma. 11th, 215 ma. 16th, 130 ma. 18th, 120 ma. 23d, 110 ma. for 5 minutes each.

March 1st, 140 ma. for 5 minutes. A perfectly natural period has been got over, during which the patient did not require to go to bed. 3d, 140 ma. 6th, 190 ma. for 5 minutes each.

The tumor is now 2 inches below the umbilicus and is more lobulated. The patient says that she feels well and strong.

On June 11th, 1889, Dr. Morgan wrote: "She is looking a great deal better, and has lost the anæmic appearance which she had. She says that there has been no flooding for twelve months. She is quite regular in her periods, and the discharge is natural and painless; and this has been the case since about four months after the ceasing the treatment. The tumor is much the same as when I last examined her—a large globular mass, tender in parts on pressure and as big as a five-months' pregnant uterus. Mrs. M. had just been changing her residence when I called, and I found her working. She says she has no more difficulty than she had seven years ago when her trouble first commenced, and can work all day without distress."

CASE LIX.—Married, age 46; came to Edinburgh in November, 1887.

Eleven years ago this lady consulted Dr. Keith on account of a bleeding fibroid tumor. Until three years ago, the bleeding became more and more profuse and very painful. About this time a mass of tumor was passed per vias naturales, and there has been some amelioration of the symptoms since then. The periods last ten, eleven, or twelve days, and the discharge is very great. They recur at regular intervals of four weeks, the patient thus being clear for between a fortnight and three weeks. There is constant pain in the right side.

The tumor is found to extend up to the umbilicus, and is

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decidedly prominent. The cavity measures 5 inches. The patient is soft and anæmic.

November 22d, 95 ma. 25th, 100 ma. 28th, 125 ma. 29th, 165 ma. for 5 minutes each.

December 13th, 130 ma. for 5 minutes. The period has been rather better than usual. 15th, 115 ma. 17th, 120 ma. 20th, 250 ma. 22d, 250 ma. 24th, 200 ma. 26th, 85 ma. for 5 minutes each.

January 7th, 1888, 210 ma. for 5 minutes. A specially bad period is over. 10th, 130 ma. for five minutes. 12th, 14th, 17th, and 19th, 175 ma. for 5 minutes. Is at last beginning to feel a little better and stronger. 21st, 160 ma. 31st, 200 ma. for 5 minutes each. The period has not been quite so bad as the last.

February 2d, 200 ma. 4th, 200 ma. 7th, 175 ma. 9th, 150 ma. 11th, 170 ma. 23d, 200 ma. for 5 minutes each. The period lasted but three days; there was little discharge, and the patient feels well. 25th and 28th, 150 ma. for 5 minutes.

March 1st, 160 ma. 3d, 150 ma. for 5 minutes each. As there had been little diminution in the size of the tumor, the sound, instead of being made positive, as it had been up till now, was made negative. 6th, 170 ma. 13th, 130 ma. for 5 minutes each. The period has been got over a week too soon. It was bad for only two days. 15th, 17th, and 20th, 150 ma. for 5 minutes. 22d, 165 ma. 24th, 160 ma. 26th, 160 ma. for 5 minutes each.

Since beginning the use of the negative pole inside the uterine cavity, there has been a marked lessening of the bulk of the tumor, and it is now not much more than half the size it was in November of last year.

CASE LX.—Married, age 51; came to the Woman's Dispensary, Edinburgh, on the 28th November, 1887.

She has had three children and three mishaps, the last having taken place ten years ago. The death of one of her three sisters was caused by the presence of an abdominal tumor. Little information could be got about this tumor, except that it had not caused any hemorrhage.

The patient herself is fat and anæmic. She says that two years ago she began to lose too much at her periods, but thought little of it until six months ago, when she felt that the increased loss of blood was beginning to tell seriously on

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her health. Now she feels that she can work no longer, and, if nothing can be done, that she must give up her situation of a Bible-woman. Some years ago the periods lasted five days; the usual length is now two weeks, and the last one continued for three weeks. In addition to the increasing debility, there is great feeling of heat and itching in the vagina.

On examination, a firm, smooth tumor, situated exactly in the centre of the lower part of the abdomen, was to be felt reaching up to within 1½ inches of the umbilicus. The cervix was in its natural position, and the sound passed easily to a depth of 7 inches. There was nothing seen in the vagina to account for the irritation.

Treatment.—7 inches of the sound attached to the positive wire were exposed, and the instrument inserted into the uterine cavity.

November 28th, 70 ma. for five minutes.

December 2d, 90 ma. 5th, 85 ma. 9th, 85 ma. 12th, 60 ma. 16th, 100 ma. for 5 minutes each.

January 6th, 1888, 140 ma. for 5 minutes. The irritation in the vagina has entirely disappeared, and there has not been any hemorrhage from the uterus for eight weeks. 23d, 105 ma. 27th, 100 ma. 30th, 125 ma. for 5 minutes each. The period came on on the 7th, and lasted fourteen days. To-day she says that she has not felt so well for about a year.

February 5th, 100 ma. 8th, 105 ma. 10th, 120 ma. 13th, 100 ma. for 5 minutes each. To-day she feels fit for work, and said, "I can do up my fireside in a different way." 17th, 165 ma. 20th, 240 ma. for 5 minutes each. Is now 8 inches less round the middle than she was three months ago. She can now button her boots, a thing she has not been able to do for eighteen months. 22d, 210 ma. 24th, 195 ma. 27th, 225 ma. 29th, 210 ma. for 5 minutes each. Felt so well that she did a washing yesterday, but is not any the better to-day for doing it.

March 2d, 225 ma. 5th, 220 ma. 7th, 210 ma. 9th, 150 ma. for 5 minutes each. As the period has been due for ten days, and as, in consequence, there is considerable feeling of fulness and discomfort, the wire from the negative pole of the battery was on this and all subsequent occasions attached to the sound in the cavity of the uterus. 12th, 240 ma. 14th, 235 ma. 19th, 250 ma. for 5 minutes each. A natural period, lasting four

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days, has given great relief. 21st, 225 ma. 23d, 240 ma. 28th, 225 ma. 30th, 245 ma. 31st, 240 ma. for 5 minutes each.

April 2d, 240 ma. 3d, 250 ma. 6th, 225 ma. for 5 minutes each.

Thirty-five applications in all—twenty-three positive and twelve negative. Patient feels quite well, and the tumor is not larger than half the size it was before the treatment was begun. In September was quite well, and able to do anything as well as she ever could in her life.

CASE LXI.—Single, age 41; was sent to Edinburgh by Dr. Bannerman from Hawick, and was treated at the Woman's Dispensary.

Eight years ago she had seen Dr. Keith on account of a small fibroid tumor of the uterus which had been accidentally discovered. It was at that time giving rise to no symptoms, and she was advised to leave it alone, unless it began to give trouble. For some years the tumor did not affect her in the slightest degree; but lately it has been growing more rapidly, and the patient has become very breathless, partly due to the pressure upward of the mass, but principally on account of anæmia. This anæmia is due to a very considerable augmentation in the quantity of blood lost while menstruating, the periods lasting eight or ten instead of four days, and to the drain of a constant leucorrhœal discharge.

On examination, a softish tumor of probably 14 or 16 pounds in weight was felt filling the abdomen and distending the flanks very considerably. On the right side it reached up to the ribs; on the left it was about one finger's breadth below their margin. The cavity measured 4 inches.

The treatment consisted as usual in the passage of the electrical current through the tumor. The negative electrode was always placed in the uterine cavity.

November 30th, 1887, 60 ma for 5 minutes.

December 5th, 90 ma. for 5 minutes. Has begun to take steel drops. 7th, 65 ma. 9th, 150 ma. for 5 minutes each. The tumor is decidedly smaller, and the patient says that "she feels fine." 12th, 140 ma. 14th, 135 ma. 16th, 140 ma. 19th, 130 ma. 22d, 110 ma. for 5 minutes each.

January 6th, 1888, 200 ma. for 5 minutes. The tumor is much smaller; it does not reach to within three fingers' breadths of the costal margin on the left side. The menstrual

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loss has been much less, and she feels better. 8th, 190 ma. 10th, 210 ma. 13th, 80 ma. for 5 minutes each. For some reason, which was not evident, the application was badly borne to-day. 16th, 155 ma. 18th, 180 ma. 20th, 205 ma. 23d, 150 ma. for 5 minutes each. Is not so breathless, and has a little more color. Has begun to take a few drops of liquor arsenicalis along with the iron. 25th, 155 ma. 27th, 110 ma. 30th, 120 ma. for 5 minutes each.

February 1st, 155 ma. 3d, 150 ma. 6th, 150 ma. 8th, 100 ma. 10th, 100 ma. 13th, 100 ma. 17th, 165 ma. 20th, 125 ma. 22d, 140 ma. for 5 minutes each. There were twenty-nine applications of an average strength of 136 ma.

The breathing has been steadily improving, and there is now little shortness of breath. The patient feels and looks very well, and the tumor has diminished in size very much. It does not extend outward on either side as far as the iliac spine, and its upper margin is barely above the umbilicus.

Dr. Bannerman wrote on the 11th July, 1888, "With regard to Miss ——, I do not think that there is any alteration in size, although it has certainly ceased growing since she left your care. Menstruation is regular, although the quantity is smaller and pale in color. Her general health is below par."

CASE LXII.—Single, age 45; was sent to Edinburgh to have a tumor removed, which was supposed to be ovarian, in the beginning of December, 1887.

The history of this case was obscure, and the tumor was noticed only a few weeks ago. For twelve years there has been a watery discharge, and there has been a great deal of abdominal pain for a year. This pain is becoming steadily worse. There is not any menorrhagia.

The patient was a tall woman, with a peculiar brownish complexion. She was much emaciated, and this symptom had been marked comparatively recently. On examining the abdomen, the skin was found to be tightly stretched over a very large prominent tumor, which extended up under the costal margins at both sides. The tumor itself was extremely soft, and must have weighed from twenty to thirty pounds. An ordinary Duncan's sound could be passed for its whole length into the cavity. The tumor was evidently uterine, and possibly malignant.

December 8th, 60 ma. for 5 minutes. The passage of the

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sound started a very brisk hemorrhage. 10th, 150 ma. 13th, 250 ma. 17th, 260 ma. 20th, 250 ma. for 5 minutes. At the first four applications the sound was made positive; to-day it was negative. The patient complains of pain in the back of a neuralgic character. This pain wakes her about four o'clock in the morning, and lasts for ten or twelve hours. It is not any better nor any worse after the applications. There is less watery discharge. 22d, 230 ma. 24th, 250 ma. for 5 minutes each. 29th, 300 ma. for 8 minutes. The lady has had a slight feverish attack. The tumor is immensely smaller, and the breadth of the hand can be placed between it and the ribs on the right side. 31st, 210 ma. for 5 minutes.

January 3d, 1888, 225 ma. 5th, 260 ma. for 5 minutes each. 7th, 275 ma. for 10 minutes. There has been less pain, and it does not begin so early in the morning, and does not last so long. 10th, 275 ma. for 10 minutes. 12th, 275 ma. for 7 minutes. 14th, 300 ma. for 10 minutes. There is now little pain. The lady says that she feels stronger, and that she can walk with more ease and comfort. 17th, 310 ma. 19th, 300 ma. for 10 minutes each. An increase in the pain to-day. 21st, 290 ma. for 10 minutes. 24th, 300 ma. for 8 minutes. 26th, 290 ma. 28th, 275 ma. for 12 minutes each. 31st, 290 ma. for 10 minutes. There is again less pain.

February 2d, 300 ma. 4th, 275 ma. 7th, 300 ma. 9th, 275 ma. 11th, 275 ma. 14th, 275 ma. 16th, 275 ma. 18th, 250 ma. for 10 minutes each. Until yesterday there had been a gradual lessening of the pain. To-day it is again severe. 23d, 250 ma. for 10 minutes. The sound was made positive. 25th, 225 ma. for 10 minutes. The pain was decidedly better yesterday; to-day it is as bad as ever. 26th, 250 ma. for 10 minutes. Less pain. 28th, 250 ma. for 10 minutes. The pain is again severe. The tumor is very much smaller, but the pain has prevented much, if any, improvement in the general condition. Quinine in large doses and other drugs gave no relief.

In September the lady was seen by the nurse, who found her at that time much improved, with the tumor continuing to diminish, with little pain, but still profuse leucorrhœa. When she was written to, as we had heard nothing of her for some months, the sister wrote to say that she had died in April, 1889, but did not give any indication of what had been the cause of death.

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CASE LXIII.—Married, age 38; was sent by Dr. Brumell, Morpeth, in December, 1887.

The history was as follows: About three years ago the patient began to lose too much blood at the periods, and to have in addition intermenstrual discharges. This went on for a year without there being much pain or discomfort. Pain of a bearing-down character then began to be felt, and was described as being terrible. At first it came only with the periods, but for some time it has been constant, and her friends say that she often suffered dreadfully. The bleedings, for the past year or eighteen months, have been most alarming; and during them the patient has had to lie absolutely quiet in bed, as the slightest movement would bring on a great rush of blood. For a long time she has been unable to walk, and for the last six months there has been great difficulty in keeping down food. For some months the discharge has been most offensive, and it has been difficult to remain in the same room with her. For a fortnight the catheter has been required, as the patient has been unable to pass water.

When the patient arrived in Edinburgh on the 7th of December, she appeared to be dying of blood-poisoning. On entering the room the smell was most offensive. She was emaciated, she was vomiting, and her general appearance was very bad. She looked as if she would not live more than a few weeks. On examining the abdomen, a large, prominent tumor extending to 2 inches above the umbilicus was felt. It was not possible to make a vaginal examination, as a sloughing mass of tumor filled the passage and extended for fully a couple of inches outside. The mass of tumor had evidently distended the cervix to its fullest extent. It was dying, and was poisoning the patient. The operation of enucleation did not present much hope, if any, of a satisfactory result, more especially as the patient had a small pelvis; but as the lady was certain to die soon if nothing were done, it was thought fair to experiment on her with electricity.

December 9th, 60 ma. for 5 minutes. The central part of the mass, situated outside the vagina, was punctured to the depth of half an inch, and the needle made negative. 11th, 275 ma. 13th, 190 ma. for 5 minutes each. 15th, 250 ma. for 8 minutes. There is already a great improvement; the patient can now pass her water; there is less smell, and the tumor

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has receded into the vagina. 21st, 200 ma. for 8 minutes. There has been a menstrual period, with less pain and less flow than usual. 23d, 250 ma. for 8 minutes. 25th, 260 ma. for 15 minutes. 27th, 250 ma. for 10 minutes. Is feeling greatly relieved, and the tumor is smaller below. 28th, 240 ma. for 10 minutes. 30th, 230 ma. for 12 minutes. The effect of the puncture and the passage of the electrical current seems to have been to concentrate the sloughing at one spot, and to render healthy the surrounding parts of the tumor, which were previously in a dying condition. A piece of slough came away to-day. The general state of the patient is much improved, and she has lost the pyæmic appearance which she had two or three weeks ago.

January 1st, 1888.—250 ma. 3d, 240 ma. for 15 minutes each. 7th, 250 ma. for 10 minutes. The period has lasted for one day only. There has not been any vomiting nor feeling of sickness for fully a week, and the patient says that she feels much stronger, though still unable to walk more than a few yards. 10th, 260 ma. 12th, 240 ma. 14th, 260 ma. 17th, 240 ma. 19th, 240 ma. for 10 minutes each. 21st, 245 ma. for 12 minutes. There has been a return of the bearing-down pain, and some small pieces of slough have come away. 24th, 255 ma. 28th, 240 ma. for 10 minutes each. A slight period is again over. The tumor is smaller and flatter above, and is a couple of inches within the vagina. 31st, 325 ma. for 10 minutes.

February 2d, 230 ma. 7th, 235 ma. for 10 minutes each. Gave chloroform two days ago and removed a large slough, which has given rise to considerable smelling discharge. To-day there is scarcely any smell. 9th and 11th, 230 ma. for 10 minutes. 14th and 16th, 225 ma. for 10 minutes. Several sloughs the size of the finger have come away. The patient feels well. 18th, 21st, 23d, and 25th, 225 ma. for 10 minutes. 28th, 230 ma. for 10 minutes.

March 1st, 225 ma. for 10 minutes. The period came on, with great pain and retention. 9th, ether; several sloughs were removed. It was never possible to attempt the removal of sloughs, except while the patient was anæsthetized, as the vagina was so tender that it was always even difficult to get the needle into the tumor. 29th, 225 ma. for 30 minutes. 31st, 210 ma. for 20 minutes.

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April 2d and 4th, 260 ma. for 20 minutes. 6th, 260 ma. for 15 minutes. The patient is now immensely better in every way. There has been less pain, less menstrual discharge; no intermenstrual discharge; no blood-poisoning; lessening in size of the tumor, and great improvement in the health and strength. Instead of causing the tumor to slough, it has almost stopped this process. Certainly without electricity the patient would have been dead months ago.

The lady came up to town in the end of May, and said that during the last two months she had been very well, and there had not been a period.

June 1st, 200 ma. for 5 minutes. 4th, 8th, and 11th, 200 ma. for 10 minutes. Is very well, and is able to be out in the park every day. Some large sloughs have come away. 13th, 220 ma. for 5 minutes. 15th, 225 ma. 16th, 210 ma. 18th, 170 ma. 20th, 170 ma. 22d, 170 ma. 23d, 150 ma. for 10 minutes each. 24th, a large slough was removed. 29th, 150 ma. for 10 minutes. The platinum-pointed sound was pushed well into the mass.

July 1st and 2d, 150 ma. for 10 minutes. 4th, 250 ma. 6th, 270 ma. for 10 minutes each. The water had to be drawn off yesterday, as the urethra had become blocked by the descent of the tumor. It has gone up again to-day. 7th and 11th, 200 ma. for 10 minutes. The period has lasted but two days. The sound was pushed to a depth of 6 inches into the tumor. 16th, 150 ma. for 10 minutes. 19th, 20th, and 21st, 125 ma. for 10 minutes. 24th, removed a mass of dry, firm slough.

August 1st, 13th, and 16th, 100 ma. for 5 minutes. 20th and 23d, 100 ma. for 10 minutes. 25th, again removed a mass of slough.

September 2d, 100 ma. 4th, 100 ma. 5th, 100 ma. 7th, 150 ma. 9th, 100 ma. 10th, 100 ma. 12th, 100 ma. 17th, 100 ma. 18th, 100 ma. 20th, 125 ma. 21st, 100 ma. 22d, 100 ma. 24th, 100 ma. 26th, 100 ma. for 10 minutes each. After great bearing-down pain a mass of tumor, the size of a fœtal head, was extruded from the vagina, and was removed under chloroform.

October 12th, 13th, 15th, 16th, 18th, 19th, 20th, 22d, 23d, and 24th, 100 ma. for 10 minutes. The tumor has again come low down, but does not project beyond the vagina. It has now the appearance of an ordinary healthy submucous fibroid, and it is worthy of note that the electrical treatment has stopped

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the sloughing and putridity of the growth, and instead of causing blood-poisoning, has been the means of curing it. 26th, 29th, 30th, and 31st, 100 ma. for 10 minutes.

November 2d, 3d, 5th, 9th, 10th, 13th, 14th, 15th, 23d, 24th, 26th, 28th, and 30th, 100 ma. for 10 minutes.

December 1st, 3d, and 5th, 100 ma. for 10 minutes.

Three attempts to remove the tumor entirely have been made since the sloughing ceased, but on account of the narrow pelvis and the great vascularity of the growth this was not accomplished.

The patient is at present at home in the country, and is to return when the tumor begins to give rise to any trouble. There were not more than two or three periods during the whole course of the treatment, but since she has been at home they have been coming regular and of normal quantity, and are not accompanied by pain.

CASE LXIV.—Single, age 34.

December, 1887.—The patient has known of a swelling in the abdomen for the past two and a half years, which has in itself given her little inconvenience, and there has not been any menorrhagia. For some months, she has been much troubled by sickness, and says that she vomits all the food she takes in the forenoon.

On examination a tumor is felt, which extends up to the level of the umbilicus, and which is almost entirely confined to the left side of the abdomen. It is also felt in the pelvis, and continuous with the uterus. The uterine cavity is not enlarged.

December 13th, 15th, and 17th, 115 ma. for 5 minutes. 20th, 130 ma. for 5 minutes. The four applications were made with the sound negative. The patient was not heard of for some little time, and when she returned she said that she had not been feeling well. She was feverish, and there was an increase of swelling in the pelvis, though the abdominal swelling had much decreased in size. As she was not comfortable at home she was admitted into the Royal Infirmary. For some weeks the temperature kept up, usually from 100° to 102°, with pulse 110 to 120. She was kept quiet in bed and gradually improved, and was able to leave hospital in good health, and with scarcely a trace of tumor to be found.

CASE LXV.—Single, age 39; was brought by Dr. Struthers, of Leith, in the beginning of January, 1888.

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This patient says that for nearly twelve years she has lost more blood during her menstrual periods than she had done for the few years before that time; but it was not until four and a half years ago that the bleeding came to be really excessive and severe enough to render it necessary for her to keep in her bed for a day or two every month. Some six months after this, a tumor was first noticed in the abdomen. For some years, there has been somewhat severe pain complained of, for the first few days of the menstrual flow. For the last two years all her symptoms have been much aggravated; the tumor has increased with great rapidity; the loss of blood every month has become very great, lasting for fourteen days, and so severe, that the patient has to lie in bed for at least one week out of every four, or in other words, for three months out of every year. The pain has become worse, and there is at all times, a most profuse white discharge. The general health has suffered greatly; there is marked anæmia, there is debility, there is breathlessness, and the feet and legs are swollen, even after lying in bed. The patient considers that she is more pulled down by the white than by the red discharge. No measurements were taken, but before treatment a 30-inch pair of stays could not be put on.

On examination the patient is seen to be a dark sallow woman, and markedly anæmic. The abdomen is filled and distended by a soft tumor of the uterus, which has raised up the ribs on both sides with the sternum. The uterine cavity was very large, a sound being passed to a depth of ten inches, and even then it did not meet with any obstruction.

The tumor was evidently a soft fibroid tumor of the uterus, but there were not any cysts to be felt.

The negative pole of the battery was at every sitting connected to the internal electrode.

January 4th, 1888, 100 ma. 7th, 150 ma. 10th, 150 ma. 12th, 200 ma. for 5 minutes each. The tumor is scarcely so tightly fixed above and is slightly movable. 14th, 235 ma. 17th, 200 ma. for 5 minutes each. The effect of the treatment is beginning to be felt in increased ease and comfort in walking. 19th, 250 ma. 21st, 350 ma. for 5 minutes each. She told us to-day that she had been able to put on a dress which was too tight to be worn, in the summer of last year. 24th, 200 ma. 26th, 250 ma. for 5 minutes each.

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February 9th, 220 ma. for 5 minutes. The first period since the commencement of the treatment is over, and, although the quantity of blood lost was much the same as usual, it was not found necessary to stay in bed for longer than two days, instead of the usual seven. 9th, 300 ma. 11th, 260 ma. 14th, 250 ma. 16th, 300 ma. 18th, 225 ma. for 5 minutes each. The improvement, which was observed almost from the first, continues. The patient walks much more easily, and finds the most difference when ascending a hill. The tumor is undoubtedly smaller; there is a decided pit at the epigastrium, and the fingers can be pushed between the tumor and the ribs, although the mass is not below and clear of them yet. 21st, 255 ma. 23d, 300 ma. 25th, 230 ma. for 5 minutes each.

March 8th, 250 ma. for 5 minutes. During this, the second period, the loss has been greater than usual, and the patient has had to keep her bed for four days. 10th, 250 ma. for 5 minutes. Now she feels much more comfortable and stronger, and went out for a walk for pleasure yesterday, and can hardly believe that she did such a thing. She is now nearly free from one distressing symptom—she can sit with little discomfort. 13th, 210 ma. 15th, 170 ma. 17th, 180 ma. 20th, 250 ma. 22d, 225 ma. 24th, 210 ma. for 5 minutes each. In every way there is decided improvement; the patient eats and sleeps well; she walks more easily, has less pain, less leucorrhœa, and the tumor is smaller.

There were twenty-seven applications of an average strength of 228 ma.

In September the tumor was smaller. The patient was better in every way, and was confined to bed for three and a half days instead of seven or eight every month, and stated that she did not lose more during the whole of the last monthly flow than she often did in one day, a year ago.

January 21st, 1889.—The leucorrhœa has entirely ceased for the last six weeks. The legs swell a little toward night. The periods last seven days instead of fourteen, and the quantity of blood lost is not more than she used to have when twenty years of age, and she does not require to stay in bed. The tumor is smaller, the patient thinks, by one-half, though it appears to be scarcely so much, perhaps somewhere between one-third and one-half, and instead of its upper limit being indefinable on account of its being hidden by the chest wall, the

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whole breadth of the hand can be placed between the ribs and the tumor. The patient says that she noticed that the mass is smaller after each period than it was after the one before. Since the tumor became so much smaller, and consequently so much more movable, there has been considerable dragging pain in both groins. This is, however, fortunately relieved by fixing the growth in one position by means of a tight pair of stays. Instead of being unable to fasten a 30-inch pair, she can now wear a 26-inch, and even then can push her hand between her clothes and the tumor.

CASE LXVI.—Married, age 48.

The tumor was first noticed in 1885, and has much broken down the health of this patient. She had never been robust, and has been a martyr to dyspepsia for many years.

On examining the abdomen, a mass extending out of the pelvis and reaching to within 3 inches of the umbilicus was felt. From the vagina it was found that the pelvis was filled by this tumor. The cervix was fixed, and the uterine cavity measured 5 inches. The tumor is situated entirely in the anterior wall, and as the posterior wall is thin, and the sound therefore will be close to the rectum, there is almost certain to be pain when the electrical current is passed.

January 9th, 1888, 50 ma. for 5 minutes. There was a good deal of pain, as had been anticipated. The sound was made negative throughout the treatment. 11th, 80 ma. 13th, 100 ma. 16th, 90 ma. 18th, 100 ma. 20th, 100 ma. 23d, 100 ma. for 5 minutes each.

February 3d, 70 ma. for 5 minutes. There has been a somewhat greater flow than usual, and the lady feels less swollen and uncomfortable than she has done for a long time. 6th, 60 ma. 8th, 100 ma. 10th, 100 ma. 13th, 100 ma. 15th, 150 ma. 17th, 100 ma. 20th, 170 ma. 22d, 130 ma. for 5 minutes each. Is feeling better than she has done for some time.

March 2d, 150 ma. 5th, 150 ma. 7th, 70 ma. 9th, 125 ma. 12th, 80 ma. 14th, 170 ma. 16th, 120 ma. 21st, 180 ma. 23d, 170 ma. 31st, 170 ma. for 5 minutes each.

April 2d, 175 ma. for 5 minutes.

April, 1889.—There has been a slow but steady improvement in the general health.

CASE LXVII.—Married, age 42; was sent by Dr. MacLeod, of Hawick, in January, 1888.

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For the last seven years there has been a steady increase in the amount of blood lost at the monthly periods. The flow was continuous for ten days, and the patient has become very nervous and sleeps very badly. There is also almost constant pain, which at times is said to be fearful.

On examination, a tumor is felt to extend to three fingers' breadths above the pubes, and in the pelvis the cervix is felt to be large and to be situated far back. The sound passes to a depth of 5 inches.

The treatment consisted in twenty-eight applications, in all of which the internal electrode was made positive. The average strength of the currents was 133 ma.

January 13th and 16th, 1888, 100 ma. for 5 minutes. The patient was much upset by the first application, but is better again to-day. 18th, 100 ma. 20th, 115 ma. 23d, 120 ma. for 5 minutes each. The lady is very sleepless; she often gets up during the night and walks about her room for an hour at a time. 25th, 150 ma. for 5 minutes.

February 1st, 100 ma. for 5 minutes. The period has not lasted so long as usual, and there has been much less discharge. 3d, 115 ma. 6th, 125 ma. 8th, 130 ma. 10th, 130 ma. 13th, 130 ma. 17th, 120 ma. 20th, 120 ma. 27th, 150 ma. for 5 minutes each. There has been rather more discharge than usual. 29th, 140 ma. for 5 minutes.

March 2d, 145 ma. 5th, 160 ma. for 5 minutes each. Severe pain in the left side is complained of to-day. There has been more or less for a long time, but it had been gradually getting better since the treatment was begun. 7th, 155 ma. 9th, 130 ma. 12th, 150 ma. for 5 minutes each. The pain in the side is very much better. 14th, 165 ma. 16th, 130 ma. 19th, 150 ma. 22d, 180 ma. 28th, 150 ma. for 5 minutes each. The period has been in every respect greatly improved; it lasted a shorter time, there was less discharge, and much less pain. 30th, 160 ma. for 5 minutes.

April 2d, 110 ma. for 8 minutes.

Extract from letter, dated 17th March, 1889: "I am very well and have kept well all the time; of course I get tired at times, and feel my side a little, but I expect this is all right. I feel very thankful to you for your clever treatment of me. Had you been in Edinburgh I would have called to see you and hear what you thought of my case. Should I get ill again I

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will just come and see you. I hope I am doing right, walking and doing any other thing I like."

CASE LXVIII.—Married, age 40; came from London to Edinburgh in January, 1888.

For some years past, when this lady was in Scotland, she has consulted Dr. Keith on account of a fibroid tumor of the uterus, giving rise to symptoms which prevent her enjoying life as she might and ought to do. At the same time those symptoms have never been of sufficient severity to make an operation justifiable. There is difficulty in walking, with pain in the left side and left leg. She can manage a mile or so with tolerable ease. At the commencement of the treatment the lady suggested that she would consider herself cured if she were enabled by its means to walk twelve miles and get up into a high dog-cart.

The tumor in January extended to a little above the level of the umbilicus on the right side, and scarcely so high up on the left. The cervix was awkwardly situated; it was so far back as to be almost out of reach.

The treatment consisted in twenty-four applications; during the first four the sound was made positive, in the remainder it was negative. Owing to the position of the tumor the applications were always painful, though there was great improvement in this respect after the mass became smaller and more movable, and when the cervix had come into its natural position.

January 14th, 1888, 100 ma. 16th, 90 ma. 18th, 150 ma. 20th, 150 ma. 23d, 100 ma. 25th, 140 ma. 27th, 150 ma. for 5 minutes each.

February 1st, 100 ma. 8th, 120 ma. for 5 minutes each. There has been rather less flow during the period which is over. There is now much less pain in the leg, and the patient can walk better. This improvement she notices most when going up and down stairs. 10th, 125 ma. for 5 minutes. The cervix is now in its normal position, and the application caused much less pain. 20th, 110 ma. 22d, 110 ma. 24th, 115 ma. 27th, 130 ma. 29th, 150 ma. for 5 minutes each.

March 10th, 150 ma. 12th, 170 ma. 14th, 150 ma. 16th, 170 ma. 17th, 175 ma. 19th, 180 ma. 21st, 170 ma. 23d, 170 ma. for 5 minutes each. Says that she feels so much better.

April 28th.—Has been able to walk four miles, and can now get up on to a drag.

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April, 1889.—Is now very well.

July 2d.—The lady called to-day; she was looking very well, said that she could do anything, and could not express how much better she feels.

CASE LXIX.—Married, age 46; came up one forenoon to the infirmary, in December, 1888.

Twelve years ago she had a small fibroid tumor of the uterus. Year by year the tumor has increased in size, until it is a thing of probably between 50 and 60 pounds in weight. For a few years there was menorrhagia; but this symptom ceased years ago without treatment. There is sometimes a little difficulty in passing water. In all other respects there is not any trouble, except from the weight of the large mass. The only sister of the patient, who is now 53 years of age, has a small fibroid tumor, which is still bleeding. I was told that a couple of years ago an attempt was made to give relief by operation, and that after two hours' work nothing was accomplished—neither removal of even a piece of ovary, tube nor tumor!

The abdomen was enormously distended by a soft, fluctuating tumor, the skin being tightly stretched over it. There was not any tumor to be felt in the pelvis, and the cervix, which was quite small, could be reached with difficulty. The sound passed a long way into the centre of the mass.

We were very anxious to try the effect of the electrical current on a fibro-cystic tumor, and although this would have been a very favorable case for operation, in spite of the size, we determined to try what could be done for her relief by the battery, and the patient was warned that there might not be any result. The treatment was carried out at the Woman's Dispensary, Edinburgh.

January 16th, 1888, 75 ma. 20th, 110 ma. for 5 minutes each. 23d, 210 ma. for 4 minutes.

February 13th, 100 ma. 17th, 150 ma. for 5 minutes each. The negative electrode was internal. The tumor is smaller, softer, and the skin is not so tense. The patient is able to button four buttons of her dress, which would not meet before. 22d, 100 ma. 24th, 200 ma. 27th, 250 ma. 29th, 350 ma. for 5 minutes each.

March 2d, 350 ma. 5th, 350 ma. 9th, 150 ma. 14th, 300 ma. 16th, 300 ma. 19th, 350 ma. for 5 minutes each. 21st,

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290 ma. for 8 minutes. 23d, 290 ma. 26th, 250 ma. 28th, 290 ma. 30th, 300 ma. 31st, 275 ma. for 10 minutes each.

April 2d, 300 ma. 4th, 220 ma. for 10 minutes each.

It will be noted that the strength of the current used in this case exceeded that of any other. Indeed, with the same battery and with the same apparatus it was possible to pass through this patient a current 25 per cent stronger than could be got through any other patient. This is to be accounted for by the thinned and tense condition of the skin and the cystic nature of the tumor, it being practically a salt solution, and offering little resistance to the passage of the electrical current.

The result of the treatment, which had, however, to be discontinued sooner than it would otherwise have been by our departure for London, was not very satisfactory. The patient felt a little lighter, and the dress, four buttons of which would not fasten, was now quite loose. The ensiform cartilage also did not stick up so prominently as it had done. The tumor did not bulge so much at the sides, and the skin was looser.

In September there was little change, except that the tumor was very much to one side.

In January, 1889, the mass, judging by the general appearance of the dress of the patient, was the same size as it had been nine months before; so that at the end of a year there had been some diminution instead of decided increase as usual. The general health was good, and the woman seemed to walk more lightly. Whether prolonged treatment would have reduced the size in any marked degree it is, of course, impossible to say; but had it been possible, I should much like to have tried.

Case LXX.—Married, age 44; four children, the youngest four years of age.

Before the birth of her last child menstruation had always been regular, lasting usually six or seven days. For the four years since the child was born there have been great and increasing quantities of blood lost. She considers that the loss has been slight if it continues for ten days, and sometimes it goes on for three, and on one occasion for six weeks. The cavity of the womb was curetted by the late Dr. Angus Macdonald without benefit. There has been in addition a profuse watery discharge since June, 1887. There is constant

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backache and very frequent headache, especially after the periods.

On examination in January, 1888, the tumor was found to extend up into the abdomen as far as midway between the pubes and umbilicus, and the depth of the cavity was 4¾ inches. Patient is very anæmic, and unable to do almost anything.

The treatment consisted in thirty-two applications, during all of which the sound was attached to the positive pole of the battery.

January 18th, 1888, 100 ma. 20th, 135 ma. 23d, 140 ma. for 5 minutes each. Patient thinks that her back is not quite so painful. 25th, 150 ma. for 10 minutes. 27th, 200 ma. for 8 minutes.

February 21st, 110 ma. for 5 minutes. The period has lasted for three weeks, though for the first ten days there was very little discharge. On the whole, the quantity has not been greater than the average. 23d, 140 ma. 25th, 140 ma. 27th, 125 ma. for 5 minutes each. Is bleeding again; but there is less headache and pain in the back than usual.

March 1st, 2d, and 3d, 130 ma. for 5 minutes. 5th, 150 ma. for 5 minutes. The bleeding has continued since the last note was made. There has not been much loss, however, and the patient is feeling better and stronger in every way, and her friends have remarked on her improved appearance. She can now go up-stairs with comfort instead of with a struggle, accompanied by an attack of breathlessness. 6th, 7th, and 8th, 150 ma. for 5 minutes. Bleeding, which has been going on since the 27th of last month, has now ceased. 9th, 140 ma. 10th, 120 ma. for 5 minutes each. The passage of the sound does not now give rise to pain as it used to do. 12th, 120 ma. 13th, 120 ma. 14th, 125 ma. 15th, 170 ma. 16th, 175 ma. 17th, 150 ma. for 5 minutes each. There has been a little discolored discharge nearly every day. 19th, 160 ma. 20th, 130 ma. 21st, 160 ma. for 5 minutes each. The patient walked farther to-day than she has been able to do for a long time. There is less leucorrhœal discharge. 22d, 150 ma. 24th, 150 ma. 26th, 160 ma. 28th, 160 ma. for 5 minutes each. 30th, 165 ma. for 10 minutes.

It will be noted that twenty-three applications were made during the month of March.

The following are extracts from various letters received:

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April 8th, 1888.—"I kept well for a month, and the bleeding came on on Sunday, the 5th April, just a little every day till Thursday, when it got worse, and has done so every day. To-day is the worst day I have had; indeed I am losing quite as much yesterday and to-day as I used to do. I did not go to bed till yesterday. I have a good deal of pain to-day. Should I take any Hazaline? Do you think that it will be necessary for me to have more electric treatment?"

May 29th, 1888.—"The previous time I wrote I had to be in bed only four days, two of which were pretty bad. I kept a month better, and then a brownish-red discharge began, just a little every day for about six days, and now it has quite stopped. I had neither to go to bed nor remain in the house, but walked about as usual. I am feeling a great deal stronger than I did, and am much surprised that I have got over my period this time so easily. Or could it be possible for me to be in the family way? I have no premonition of anything as yet, but with the losing so very little this time I have a dread of it."

October 3d, 1888.—"I am sorry to have to tell you that I have had a bad period this time. I have been very well for the last few months, a month and six weeks being between the periods, although the time they lasted was from ten days to a fortnight. This time I was better for two months, and then the bleeding came on very gradually. I went about for three or four days; then I had to keep on the sofa; and, latterly, had to rest in bed for four days. I thought I was almost better, and got up, when the bleeding returned pretty bad, and has continued; one day a good deal better and another day a good deal worse. I am rather downhearted, as I thought that I was cured."

December 17th, 1888.—"I have had another rather bad period. It was nearly eight weeks between the last; but during the interval, after getting better of the last period (I was a fortnight unwell), I was quite well for a week, when the bleeding came back and lasted a week; but I did not require to rest in bed. The bleeding then returned, a little every week, for three or four hours, mostly every day, for three or four weeks, and about a fortnight before I became unwell this time it had quite disappeared. The bleeding came on more rapidly on the 5th December. I was able to be out of bed till

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the 10th, the bleeding then being worse than I have had it since I had your treatment. I got up on the 13th, but had to return to bed, as I had a great deal of pain and the bleeding was pretty bad. I am still in bed, and the bleeding is nearly gone."

January 19th, 1889.—On examination, it was found that the uterus appeared to be of normal size. On the whole the patient said that she is much better and the bleeding is much less, but it often comes on without warning and at irregular times.

CASE LXXI.—Married, age 46; was sent to Edinburgh by Dr. Mackie, Brechin, in January, 1888.

It is ten years ago since the tumor was first noticed, and it has gradually given rise to more and more discomfort and feeling of fulness and weight in the pelvis. The "periods" are profuse, and have been accompanied for a long time by sickness, and, in addition, she is seldom free from such attacks for a week at a time. On examination, the cervix was felt to be large, the cavity of the uterus measured five inches, the sound passing behind the mass of tumor, which reaches up to the level of the umbilicus.

The treatment consisted in twenty-three applications, the current being allowed to flow from the abdomen to the sound in the cavity. At no time was the passage of the current well borne; at first it was decidedly painful, and even toward the end of the treatment it was not possible to employ a strong current.

January 21st, 1888, 50 ma. 23d, 50 ma. 25th, 45 ma. for 5 minutes each.

February 7th, 40 ma. for 5 minutes. There has been rather more discharge than usual, but unaccompanied by an attack of sickness. The application to-day was more easily borne. 9th, 70 ma. 11th, 70 ma. 14th, 100 ma. 16th, 50 ma. 18th, 100 ma. 21st, 55 ma. for 5 minutes each. The tumor is smaller, and the patient says that she feels more comfortable. 23d, 75 ma. for 5 minutes.

March 3d, 80 ma. 6th, 90 ma. 8th, 85 ma. 10th, 70 ma. 13th, 85 ma. 15th, 75 ma. 17th, 80 ma. for 5 minutes each. Feels better and lighter, and has not had an attack of sickness since the treatment was begun. 20th, 27th, 29th, and 31st, 80 ma. for 5 minutes.

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April 2d, 80 ma. for 5 minutes. The patient said to-day that at the commencement of the treatment she would have been much pleased to leave Edinburgh, but that now she sees what a pity that would have been. The tumor can be scarcely felt above the pubes.

June 8th.—"Dr. Mackie thought the tumor much reduced a month ago, and I am better in the way of not being so often sick or having quite so many internal bothers. The thing that disappointed me was, and is, that I am not a bit stronger generally, nor able to do more or walk farther. The headaches, too, are just as bad."

June 28th, 1889.—"When I wrote last summer, three months after seeing you in Edinburgh, I was feeling always weak and tired, but since that I have got much better. When tired I still have twinges in the old spot, and long railway journeys rather knock me up, but I had a very good winter (never had to send for Dr. Mackie from autumn to spring), and am certainly quite different from what I was when you saw me last."

CASE LXXII.—Single, age 42.

For 12 years there has been profuse menorrhagia; but the patient says that she picks up very quickly between the periods. She says that she thinks that she does not exaggerate, when she states, that three pints of blood are often lost. On the second night of the flow, the bed has to be made up with towels and extra sheets, to prevent its being soaked with blood. The period lasts six days, and now there is not any pain.

On examination the fundus uteri is found to be lying far back in the hollow of the sacrum. There is no cervix, and the os looks forward. The cavity measures five inches.

January 28th, 1888, 50 ma. for 5 minutes. On moving the sound in the cavity, there was a feeling as if a soft polypus were present. Chloroform was given on the 31st, and a clump of very small mucous polypi were scraped from the fundus.

February 13th, 70 ma. for 5 minutes. The period has been scarcely so bad as usual. 15th, 85 ma. for 7 minutes. 17th and 20th, 100 ma. for 5 minutes. The uterus has now left its position of retroversion, and the sound passes forward. The upper part of the tumor, which was at first to be felt lying in the hollow of the sacrum, is almost touching the anterior

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abdominal wall. 24th, 100 ma. 28th, 110 ma. for 5 minutes each.

March 8th, 120 ma. for 5 minutes. The period has been as bad as ever. 10th, 130 ma. 12th, 90 ma. 13th, 150 ma. 14th, 110 ma. 15th, 110 ma. 17th, 140 ma. 19th, 160 ma. 21st, 170 ma. 23d, 210 ma. for 5 minutes each.

It was arranged that the treatment was to be continued in London, but, owing to the death of a sister, it has not been gone on with. There has not been improvement.

Case LXXIII.—Single, age 40.

This lady had a large soft fibroid extending well under the ribs on either side. The tumor was first noticed six years before, when it was already of some size. She had neither pain nor hemorrhage, and treatment was undertaken simply with the view of reducing the size of the tumor. The uterine cavity was 3½ inches.

February 18th, 1888, 55 ma. 21st, 100 ma. 23d, 130 ma. 25th, 125 ma. 27th, 180 ma. 29th, 185 ma. for 5 minutes each.

March 2d, 200 ma. for 5 minutes. The tumor is free of the ribs. On the left side a mass has come from underneath the ribs, which has much the appearance of a large spleen. It turned out to be an outgrowth from the tumor. 5th, 230 ma. 7th, 225 ma. 13th, 190 ma. for 5 minutes each. There has been more flow than usual. 15th, 210 ma. 17th, 210 ma. 19th, 200 ma. 21st, 210 ma. 23d, 250 ma. 26th, 260 ma. 28th, 250 ma. 30th, 110 ma. for 5 minutes each.

The tumor can now almost be pushed to the left side of the middle line. This caused a little pain, and it was proposed that the application should not be made, more especially as the lady said that she had felt some pain for a day or two in the left side. She made light of this, however, and as the application was to be the last in Edinburgh, it was given. It was made only half the usual strength. She had in all eighteen negative applications, and she intended to come south and continue the treatment if necessary. Sixteen days after coming to London I had a letter from a medical friend in Edinburgh, who had been asked to see her. She had gone about a good deal; the weather was bitterly cold, and she had got a chill. She had severe pain over the region of the spleen, with fever. This continued for four days, and was followed by vomiting and diarrhœa. She then began to improve, was

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sitting up in bed and talking of going south as soon as she was able. The night before I heard of her, she was seized with two floodings during the night, so severe that she was for some time pulseless after the second attack. The hemorrhage then ceased, but there was a sudden return of it next day, and she died during it. One cannot help thinking that plugging the cervix or vagina, which in her case was short and small, might have saved her.

CASE LXXIV.—Married, age 27; came to the Woman's Dispensary, Edinburgh, on February 1st, 1888.

Patient had been married for two years, and had not been pregnant. A year ago she began to have some difficulty in passing water at times, and four months afterward the water had to be drawn off with a catheter just as the menstrual flow was commencing. Since that time the catheter has been required to be used on several occasions. Menstruation has been for some years profuse, and the usual time the flow is on is twelve days. In the Royal Infirmary, where the woman was a patient for some weeks, Barnes' bags were used, and she was told that they did her good; she, however, did not feel any benefit.

The patient was a small, delicate-looking woman, and on examination it was found that the uterus, enlarged to the extent of almost filling the pelvis, was retroverted; the cervix had been completely drawn up into the mass, and the os could be reached with difficulty immediately behind the upper margin of the pubes. On account of its relation to the bone it was not possible to bend a sound so as to allow of its entrance into the interior of the womb. It was therefore necessary to puncture in the centre of the mass.

February 1st, 40 ma. 3d, 25 ma. for 5 minutes each The puncture was repeated a second time. On both occasions the patient complained of great pain. On the 27th of the month she came back. She had passed through a menstrual period more easily than usual. It had lasted six instead of twelve days; there had been less discharge, and there had not been any stoppage of the water. A marked difference in the local condition was felt; there had been partial rotation of the uterus; there were some appearances of a cervix, and the os, which was now midway between its old position behind the pubes and the ordinary one, could be easily entered by the

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sound, which passed to a depth of 4¼ inches. 27th, 75 ma. 29th, 50 ma. for 5 minutes each.

March 5th, 70 ma. 9th, 40 ma. 19th, 100 ma. for 5 minutes each.

It was not necessary to puncture on any of these occasions. The patient did not feel any better, and had had to take off the water once.

Seven applications, five negative with sound in the cavity, two negative punctures, the average strength being 57 ma. This patient was entirely lost sight of.

CASE LXXV.—Age 49.

In the end of 1885, or beginning of 1886, a submucous fibroid the size of the fist was removed. This tumor had caused excessive hemorrhage, and the periods became normal after its removal. Pain was, however, said to be more or less constant, and in the beginning of 1888 fourteen applications of electricity were made, the sound being negative.

February 7th, 45 ma. for 5 minutes.

March 3d, 55 ma. 6th, 65 ma. 8th, 100 ma. 10th, 100 ma. 12th, 80 ma. 15th, 125 ma. 17th, 120 ma. 20th, 100 ma. 22d, 130 ma. 24th, 120 ma. 27th, 125 ma. 29th, 135 ma. 31st, 85 ma. for 5 minutes each.

The average strength was almost 100 ma.

The result was some diminution in the amount of discomfort.

CASE LXXVI.—Age 35; came to the Woman's Dispensary on the 10th of February, 1888.

A tumor had been noticed in the abdomen eleven years ago. Increase of menstruation for last eight years. The periods, which formerly lasted three or four days, are now prolonged to fourteen and sixteen. Has been in the infirmary under the care of Professor Simpson and the late Dr. Angus Macdonald, and says that she has consulted a great number of doctors. Injections of ergot have been tried, and have failed to arrest the bleeding.

A large tumor extending up underneath the ribs on both sides was felt. The os was situated far back, and the sound passed 8 inches into the uterine cavity.

A current of 70 ma. was passed from the abdomen to the sound for 5 minutes.

This patient did not come back, and I heard nothing more of her. The visit was somewhat of a begging nature.

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CASE LXXVII.—Married, age 48; was sent by Dr. Connel, of Peebles.

Until the age of 35 the general health was very good, and the periods recurred with unfailing regularity every four weeks. Since that time there has been a decided increase, the quantity of blood lost steadily increasing, until now it is about four times as much as it used to be, and instead of recurring every four weeks, the flow usually puts in its appearance every two, and never at a longer interval than three weeks. Headaches are often very severe, and the lady is frequently confined to bed, and says that she feels a loss of brain power. A visit to Schwalbach did good for some time, but toward the end of 1887 she completely broke down.

The tumor is not prominent, and extends to within 2 inches of the umbilicus. The cavity measures 4¾ inches.

February 23d, 1888, 100 ma. 25th, 115 ma. 27th, 140 ma. 29th, 160 ma. for 5 minutes each.

March 1st, 165 ma. 2d, 180 ma. 12th, 110 ma. for 5 minutes each. The period is over; the quantity has been the same as usual, but the patient feels better. 13th, 160 ma. 14th, 180 ma. 15th, 180 ma. 16th, 175 ma. 17th, 185 ma. 19th, 180 ma. 20th, 190 ma. for 5 minutes each. Usually at this time the lady feels ill, but as yet she is very comfortable. 21st, 210 ma. 23d, 160 ma. 24th, 175 ma. 26th, 150 ma. 27th, 160 ma. for 5 minutes each. The treatment was discontinued, and is to be begun again in London in a month or so. Before it was restarted we had come to the conclusion that it was a mistake to make the applications as quickly as had been done in this case, viz., twelve in fifteen days.

April 21st, 100 ma. 23d, 115 ma. 25th, 150 ma. 27th, 100 ma. 30th, 100 ma. for 5 minutes each.

May 2d, 85 ma. 4th, 125 ma. 14th, 115 ma. for 5 minutes each. The patient is sleeping much better and looks better. 16th, 115 ma. 18th, 100 ma. 23d, 115 ma. 25th, 125 ma. 28th, 125 ma. 30th, 125 ma. for 5 minutes each.

June 11th, 110 ma. for 5 minutes. The sound was always attached to the positive pole of the battery. The average strength was 140 ma.

The period has been, on the whole, better, and the lady's son thinks that she is much improved.

The after-history has not been satisfactory. The only dif-

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ference that we can think of to account for this is that some of the applications were made with little or no interval between them.

CASE LXXVIII.—Married, age 51; was sent through from Glasgow by Dr. Moore, and attended the Woman's Dispensary, Edinburgh.

Menstruation began at the age of fourteen, and was accompanied by somewhat severe pain until marriage, at the age of 37. Four children were born, and the general health was good until three years ago. About this time the flow every month began to be prolonged, and soon, instead of returning every month, it sometimes made its appearance every fortnight, lasting for ten instead of six days. Dysmenorrhœa which had been absent for eleven years returned. A year after these symptoms appeared, a swelling was felt in the abdomen. This swelling is slowly increasing in size, and has given rise to constant pain and to a great deal of suffering

On examination, the swelling is found to extend to six inches above the pubes and to distend the abdomen a little. In the pelvis it is found to press on the bladder and to fill the whole pelvic cavity. The sound passes 4½ inches.

In the treatment of this case negative applications were made.

February 29th, 1888, 65 ma. for 5 minutes.

March 2d, 100 ma. 5th, 140 ma. 7th, 125 ma. for 5 minutes each. Both above and in the pelvis there is a marked difference, even from day to day. 9th, 135 ma. 14th, 140 ma. for 5 minutes each. Patient remarked that she had so much less pain. 16th and 26th, 125 ma. for 5 minutes. The period lasted one day longer than usual, but there was much less blood lost, and less pain. The tumor is smaller in the pelvis, and extends to three instead of to six inches above the pubes. 28th, 160 ma. 30th, 135 ma. 31st, 145 ma. for 5 minutes each. There is still some pain at one spot in the left side.

April 2d, 135 ma. 3d, 160 ma. 5th, 210 ma. 6th, 200 ma. for 5 minutes each. In all, fifteen applications, with an average strength of 140 ma.

The pain in the left side has gradually become less, and is now quite absent. The patient is in much better health and spirits; she has lost her look of depression, and the tumor is about one-third the size it was five weeks ago. The way in

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which this tumor decreased from day to day was very remarkable.

Dr. Moore wrote on the 20th June, 1889, "I have just had an interview with Mrs. ——, and I am glad to say she has had no return of hemorrhage since you operated. I had no opportunity of examining the remains of the fibroid; but she says that she thinks it is all gone. You remember the poor woman was fast sinking from hemorrhage, when you kindly took her in charge. In her own words, she was 'never dry.'"

Case LXXIX.—Married, age 37; came into Edinburgh in the beginning of March, 1888.

An abdominal swelling was first noticed about five years ago, and although there have been occasional attacks of pain in it, there was really little trouble until a few months ago. The patient has found that of late her general health has been failing, and that the quantity of loss at the periods has been increased, and there has been great pain. The most annoying symptom is, however, a difficulty in passing water; and on one occasion there was complete stoppage, and relief had to be given by emptying the bladder with a catheter.

On examination, a very prominent tumor, reaching up to the level of the umbilicus, is found. There is not any cervix, and the opening into the uterus is situated high up on the left side, and almost out of reach of the finger.

The treatment consisted, unfortunately, in only ten negative applications.

March 7th, 1888, 75 ma. 9th, 125 ma. for 5 minutes each. The patient felt very tired yesterday after the first application. There is a marked diminution in the size of the tumor after only one sitting. 12th, 125 ma. 14th, 115 ma. for 5 minutes each. Already the patient says that her dress feels much looser, that she can walk better, and has now not any discomfort with the bladder. The tumor is immensely smaller, and the os uteri is an inch lower down. 16th, 100 ma. 19th, 150 ma. for 5 minutes each. Every day the tumor is found to be smaller. 28th, 150 ma. for 5 minutes. The period has been quite easy, and the patient is much surprised that there was not any trouble or discomfort of any kind. 30th, 150 ma. 31st, 160 ma. for 5 minutes each.

April 2d, 130 ma. for 5 minutes. The tumor is to-day about one-third the size it was less than four weeks ago. The aver-

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age strength of the ten applications was rather more than 120 ma.

CASE LXXX.—Age 34. In this patient there had been great difficulty in her last two confinements on account of a tumor filling up the cavity of the sacrum. She was seen several times at intervals of a few months before the treatment was commenced. There was steady increase in the size of the tumor, which extended half-way up to the umbilicus when the first application was made. The mass comes off from the back of the uterus, which is easily felt above the pubes, being entirely drawn into the abdomen. The posterior lip of the cervix is quite lost in the tumor. The left ovary is easily felt; it is always tender and irritable.

The treatment consisted in thirty applications. Negative puncture was almost always used. As the tumor diminished the sound could be passed into the cavity of the uterus, and some of the applications were made that way, toward the end of the treatment. In this case there was more pain experienced by the negative puncture than we had ever met with, and some of the punctures were followed by profuse watery discharge, which continued for several days. In spite of the pain, the patient asked for the puncture, as she always felt so much more relieved by it.

March 12th, 1887, 55 ma. 14th, 100 ma. 16th, 80 ma. 19th, 90 ma. 21st, 100 ma. 23d, 135 ma. for 5 minutes each. The tumor is smaller.

April 12th, 110 ma. for 5 minutes. Has had an easy period. 14th, 65 ma. 17th, 60 ma. 19th, 60 ma. for 5 minutes each. 21st, these last punctures have been somewhat painful. The left ovary is much more free, and the body of the uterus more distinct from the mass behind—altogether smaller. A great deal of watery discharge. As there is still some pain, no application was made to-day. 23d, 60 ma. for 5 minutes.

May 2d, 60 ma. for 5 minutes. 7th, 50 ma. for 10 minutes. 9th, 155 ma. for 5 minutes. To-day sound passed into cavity of uterus. There has been profuse watery discharge, which has given great relief. 11th, 55 ma. 14th, 140 ma. 16th, 70 ma. 26th, 70 ma. 28th, 30 ma. for 5 minutes each. There is a distinct cervix to-day, and all bladder trouble has ceased. Feels by her dresses how much smaller the tumor is. The last puncture was again painful, and only 30 ma. could be

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borne. Great watery discharge followed. The rest of the applications were now made easily in the cavity of the uterus.

June 2d, 110 ma. 4th, 120 ma. 6th, 150 ma. 8th, 170 ma. 11th, 130 ma. 13th, 160 ma. 21st, 130 ma. 23d, 140 ma. 25th, 135 ma. 27th, 135 ma. for 10 minutes each. The last period was good and painless. There has been marked diminution in the size of the tumor. The patient returns home feeling well. The tumor is now central, and one-fourth the original size. Nothing remains but a thin flattened mass in the roof of the pelvis. Now it is impossible to tell what the tumor is. It might easily be mistaken for a simple cellular swelling.

June 29th, 1889.—This lady writes, "I am really very well, and able for any ordinary amount of fatigue. The periods continue quite normal, so different to what they used to be. In fact, I really am very well."

CASE LXXXI.—Married, age 40; came home from India for the electrical treatment in the beginning of 1888.

This lady had never been at all robust, but she had been able to enjoy life until a few years ago. A fibroid tumor of the uterus had been responsible for her bad health in late years, and she is very anxious to be relieved of her pain and discomfort, and to get strong again.

The chief symptom is pain, situated principally in the lower part of the back. There is also a general feeling of discomfort and fulness, much worse during the periods, which are greatly in excess, and which also appear too often. The lady looked ill; she was thin and wan, and on examining the abdomen a very prominent tumor was seen and felt. The mass extended upward to 1½ inches above the umbilicus. The abdominal wall was thin, and was tightly stretched over the tumor. On passing the finger into the vagina the growth is felt almost at once, and is found to be tightly packed into the pelvis. The cervix is obliterated, and the os is situated as far back as possible, and toward the right side.

March 23d, 1888, 60 ma. for 5 minutes. As was to be expected from the position of the uterine canal, the application was not well borne. 26th, 55 ma. 28th, 60 ma. for 5 minutes each. The sound passed much more easily.

April 25th, 75 ma. for 5 minutes. The treatment which had been begun in Edinburgh was recommenced, after a month's interval, in London. There is now quite a well-marked cervix. 27th, 70 ma. for 5 minutes. The tumor is decidedly smaller.

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May 10th, 65 ma. for 5 minutes. The period has been got through much more easily than usual; the long interval of rest from treatment being accounted for by an attack of dysentery. 12th, 65 ma. 15th, 60 ma. 17th, 85 ma. 19th, 45 ma. for 5 minutes each. Until to-day the sound has been connected to the negative pole of the battery; but on account of there being more pain than usual, it was made positive, and gave great relief.

June 8th, 50 ma. for 5 minutes. A return was made to the negative sound. The tumor decreases steadily, and the abdominal wall is taking on fat. The period was much as the last. 11th, 45 ma. 13th, 70 ma. 15th, 50 ma. 30th, 40 ma. for 5 minutes each. A very easy period, with little flow.

July 2d, 65 ma. 4th, 75 ma. for 5 minutes each. Said that she felt very tired yesterday evening, but allowed to have been shopping for four or five hours. 6th, 75 ma. 11th, 80 ma. 26th, 55 ma. 28th, 75 ma. 30th, 85 ma. for 5 minutes each.

August 1st, 85 ma. 3d, 100 ma. 6th, 80 ma. 21st, 105 ma. for 5 minutes each. The period has been again easy. 23d, 75 ma. 25th, 120 ma. 27th, 135 ma. 29th, 135 ma. for 5 minutes each. The sound was made positive during the last four applications. The lady is very well, and the tumor is decidedly less than half the size it was. The average strength of the thirty applications has been 75 ma.

May, 1889.—The general health has been very good, and the lady has been able to do anything she wanted to for the last nine months. She has entirely lost her old haggard look, and has now a clear, fresh complexion. The tumor is rather smaller than it was in August of last year, and the wall is quite fat, and is quite loose.

Case LXXXII.—Single, age 36; was sent by Dr. Priestley.

The history of this patient was, that for a number of years she had not known what it was to feel well, even for a day. She was always more or less ill, but this she would have been able to put up with, had it not been that, during the time of the menstrual flow, she suffered terribly from pain, from headache, from sickness, and from menorrhagia. For those attacks of pain and sickness, which recurred at intervals of three weeks, morphia had been taken in increasing doses for some years.

Treatment of all kinds had been tried without relief. It

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had been suggested that she should have an operation, but this, both she and her friends would not consent to.

On examination, a fibroid tumor of the uterus was found to entirely fill the pelvis. The exact condition was made out with some little difficulty, on account of excessive tenderness in every direction. The passage of the sound was not easy from the same cause. Treatment by electricity was agreed to, and the lady came to town twice a week for the applications. She had a railway journey of one and half a hours each way.

April 9th and 11th, 50 ma. for 5 minutes. The passage of the sound causes so much pain that the applications were badly borne. She was very tired after the first one. 13th, 70 ma. for 5 minutes. 16th, 18th, and 20th, 65 ma. for 5 minutes.

May 1st, 50 ma. for 5 minutes. The period has been quite as distressing as usual, and the usual doses of morphia were taken. 5th, 60 ma. 8th, 80 ma. 12th, 60 ma. 15th, 90 ma. 29th, 40 ma. for 5 minutes each. There has been more flow, but accompanied by less pain and headache, and no morphia has been taken for three weeks. This is said to be the longest time she has gone without the drug for some years.

June 2d, 50 ma. 4th, 65 ma. 7th, 75 ma. for 5 minutes each. Says that she is feeling decidedly better, and, in fact, almost quite comfortable. The tumor is much smaller. 13th, 75 ma. 16th, 70 ma. 30th, 60 ma. for 5 minutes each. There has been a wonderfully easy period, and now the patient feels well. She thinks that her progress is wonderful.

July 3d, 75 ma. 7th, 80 ma. 10th, 75 ma. 14th, 70 ma. 17th, 70 ma. 28th, 50 ma. for 5 minutes each. There was much less pain, and no morphia was required.

August 4th and 11th, 50 ma. for 5 minutes. There is now scarcely any trace of tumor; and although the strength of the current has never been great, the treatment will be discontinued in the mean time.

May, 1889.—On examination, the pelvic contents appear to be normal. There is still some pain and occasional headache, but the improvement is very great, and morphia is not required.

Case LXXXIII.—Married, age 48; came to Edinburgh in the beginning of March, 1888.

The history of this lady's illness dates back to the year

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1874; at least this was when she first consulted a doctor about an increasing monthly loss. In 1876 she was under the care of Dr. Murray, of Newcastle, and in 1877 she went to Edinburgh to see Dr. Keith. Owing, however, to his being away from home, the patient saw Dr. Matthews Duncan. At that time the symptoms appear to have been hemorrhage, leucorrhœa, and pain. She was sent to Germany for some time, and when she again arrived in Edinburgh it was found that a submucous tumor was presenting. It was sloughing, and was removed, and the lady survived a severe attack of blood-poisoning. Dr. Duncan told her that it was not at all unlikely that she would have another of these tumors. She kept well for two years, and then all the old symptoms returned, and gradually got very bad, and the lady became too ill to travel. In 1882 Mr. Teale, of Leeds, removed another tumor after dilatation of the os, and as she had not improved, she was curetted once in 1883. Since that time she has been steadily going down hill, and nothing had done her good except visits to Woodhall Spa.

Now she suffers from excessive losses of blood every month, and is always in bed for four or five days, and there is, and has been for many years, a constant white discharge from the uterus.

The general condition is very bad, and the lady is very anæmic. For years the patient has been unable to sit or to lie on the right side.

On examination in March, 1888, it was found that there was a fibroid tumor of the uterus, extending up to the level of the umbilicus, and that the os uteri was somewhat open. As it was evident that the presence of a submucous tumor was more than likely, the os was dilated, and while there was some roughness of the lining surface to be felt, nothing of the nature of a tumor was found.

April 9th, 1888, 115 ma. for 5 minutes. 11th, 90 ma. 13th, 120 ma. for 7 minutes each. 14th, 120 ma. for 5 minutes. The lady was able to walk to Clarges Street after the application. 16th, 130 ma. 26th, 125 ma. for 5 minutes each. There has been decidedly less bloody discharge than usual. 28th, 115 ma. 30th, 120 ma. for 5 minutes each.

May 7th, 140 ma. for 7 minutes. There has been another attack of bleeding and the applications are to be made in

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future while the lady is in her own bed. 9th, 150 ma. 11th, 150 ma. 22d, 110 ma. for 5 minutes each. There has been a smaller loss than usual. 24th, 170 ma. 26th, 200 ma. 28th, 175 ma. 30th, 110 ma. for 5 minutes each. There is some decided improvement in the general appearance, and the patient says that she feels better.

June 1st, 175 ma. 2d, 175 ma. 4th, 200 ma. 6th, 175 ma. 8th, 175 ma. for 5 minutes each. The period is on; but the applications are to be continued through it. 11th, 175 ma. 13th, 160 ma. for 5 minutes each. Patient says that she feels better than she did after the last period was over. There was rather more discharge. 15th, 150 ma. 16th, 160 ma. for 5 minutes each. 18th, 150 ma. 20th, 150 ma. 22d, 150 ma. 23d, 140 ma. for 8 minutes each. The tumor is smaller, and the patient looks better, and says that she feels better in every way.

After going home there was at first little if any improvement, but on the 23d November we had better news: "I really have had a better time, I am very thankful to say, and if only a few of these would come, I should be making way."

December 19th.—"It really seems as if the improvement had begun. The last time was the best I have had yet; much less pain; and though I began nearly a week before time, I was not so restless and uneasy either at the time or on the mend. I still have a great deal of whites, especially the last few days, when I have been out in the Bath chair. I begin to think, at this time of year, the shaking I get counteracts the good from the fresh air. I do feel very thankful for this improvement, and pray it may continue."

The next period was a bad one, and the patient came back to town in the beginning of February, and on asking if she felt better than she did before the treatment, she replied that she would not have come back had she not felt better. The tumor was found to be 2 inches below the umbilicus, and projecting through the os, which was dilated to the size of a shilling, was an intra-uterine fibroid.

The cervix was dilated, and on the 16th February the tumor was removed piecemeal. It was attached to the fundus on the right side, corresponding to the spot where there was constant pain. Within a few days the white discharge, which had not been absent for years, entirely ceased, and before going home the lady could sit up to her meals.

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July.—The patient is steadily improving.

CASE LXXXIV.—Married, age 29; was seen with Dr. Matthews Duncan.

The patient is a fragile, delicate woman, and has been much pulled down in the last few years by too frequent and too profuse losses of blood at the periods. It is not necessary to say that all treatment short of operation has been tried.

On examination, it was found that the pelvis was filled by a tumor, which reached up into the abdomen. The cervix was small and lying on the pelvic floor. Examination was difficult on account of great tenderness.

It was determined to begin with a weak strength of current, and to make the applications at the lady's own house; and on every occasion the sound was made positive.

April 14th, 1888, 30 ma. 16th, 30 ma. 18th, 45 ma. 20th, 40 ma. for 5 minutes each. 23d, 35 ma. for 8 minutes. 25th, 35 ma. 27th, 30 ma. for 10 minutes each.

May 7th, 40 ma. for 10 minutes. The period has been much as usual. 9th, 100 ma. 11th, 70 ma. 14th, 90 ma. 16th, 90 ma. for 5 minutes each. There is not much appreciable difference, except that the lady feels better than usual on the day after each application. 19th, 80 ma. 21st, 110 ma. for 5 minutes each.

June 1st, 65 ma. for 5 minutes. The period only lasted five days. 4th, 80 ma. 6th, 75 ma. 8th, 90 ma. 19th, 50 ma. for 5 minutes each. There has been rather a profuse discharge, but in spite of it the lady feels better. 21st, 55 ma. 22d, 95 ma. 25th, 90 ma. 27th, 100 ma. for 5 minutes each.

July 6th, 80 ma. 9th, 80 ma. 11th, 90 ma. 18th, 90 ma. for 5 minutes each. The smallest period she has had for a very long time, and the lady is in great spirits and feels well. 20th, 70 ma. 30th, 65 ma. for 5 minutes each.

August 1st, 3d, and 6th, 50 ma. for 5 minutes. The average strength of the thirty-two applications was between 65 and 70 ma.

Feels very well. Locally there had not been very much change, though there has been some diminution in the size of the tumor. The lady was good enough to keep a record of the periods after the treatment for nearly a year.

Period commenced on August 5th and did not stop till the 19th. After an interval of twelve days, the flow returned and

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continued for five or six days. Interval of four weeks followed by flow for six days, and again a flow of four days after eight days' interval. Then there was nothing for five weeks but one day, and the period was much better and only lasted five days. Clear from 3d December to 6th January, 1889; then for five weeks and a day. Since February the flow appears regularly at intervals of three weeks and four days, and is not more than it used to be before the beginning of the illness.

Extract from letter dated 7th June, 1889: "Will it be convenient if I come to see you some time to-morrow morning, and if so, what hour would suit you best? I want you to see how much better I am, thanks to your wonderful treatment."

CASE LXXXV.—Married, age 45; was seen in April, 1888, in consultation with Dr. Butt.

A number of years ago it was first noticed that the quantity of blood lost every month began to increase, and in the summer of 1882 the lady was sent to Kreutznach. This visit was repeated in the two succeeding years. In 1886 to 1887 visits were paid to Woodhall Spa. However, neither Kreutznach nor Woodhall succeeded in diminishing the loss, although they may have prevented its becoming worse. The hemorrhage is so excessive that the patient is frequently confined to bed for two weeks at a time, and she often is so weak and drained that she feels as if she would die. Large clots are passed, and pailfuls (*sic*) of blood. There is pain in the tumor on movement, and she can walk a very little distance at a time.

The patient is very anæmic and breathless, and the tumor, which is not particularly prominent, extends up to the umbilicus. The uterine cavity is large from side to side, and measures 7 inches in depth.

The lady was very anxious to try the electrical treatment, more especially as a friend was at the time under Dr. Apostoli in Paris, and had much improved. The course of treatment extended from the 30th April until the 6th August, and consisted in thirty-two applications, the internal electrode being on every occasion attached to the positive pole of the battery.

April 30th, 1888, 70 ma. for 5 minutes.

May 9th, 110 ma. for 5 minutes. The first application was made in Charles Street, and as it was followed by profuse bleeding for ten days, all subsequent applications were made

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at the lady's own house. 11th, 110 ma. 14th, 110 ma. 16th, 115 ma. for 5 minutes each. Is beginning to feel stronger. 18th, 110 ma. 21st, 145 ma. for 5 minutes each. There is a little bleeding to-day. 23d, 150 ma. for 5 minutes. When the patient gets up there is a little red discharge from the uterus. 25th, 160 ma. 28th, 140 ma. for 5 minutes each. The bleeding has now entirely ceased, and the tumor is smaller. 30th, 180 ma. for 5 minutes. Is feeling much stronger, and has been out in a Bath chair.

June 2d, 150 ma. 4th, 190 ma. 6th, 160 ma. 8th, 195 ma. for 5 minutes each. Still feels stronger. There has been a slight red discharge both yesterday and to-day. 11th and 18th, 150 ma. for 5 minutes. The first proper period for six weeks is over. The flow continued for six days, and was by no means excessive. Feels well. 20th, 150 ma. 22d, 180 ma. 25th, 180 ma. 27th, 160 ma. for 5 minutes each. The patient feels very well, in spite of the fact that one of her relations who lives with her is seriously ill. 29th, 150 ma. for 5 minutes.

July 2d, 150 ma. for 5 minutes. Was at the Danish Exhibition for seven hours on Saturday, and at church the day after, without being over-fatigued. 18th, 100 ma. for 5 minutes. Patient went to the country for the period. She caught cold, and there was a great deal of pain in the womb. The amount of blood lost was not nearly so great as before. 20th, 110 ma. 23d, 170 ma. 25th, 125 ma. 27th, 125 ma. 30th, 120 ma. for 5 minutes. The patient walked farther yesterday than she has done for a very long time.

August 1st, 150 ma. for 5 minutes. Yesterday was in the Academy for an hour and a half, standing the whole of the time, and got home without feeling tired, and without any of the old pain in the womb, which used to be so bad when she stood. 3d, 150 ma. 5th, 140 ma. for 5 minutes each. Though there does not appear to be much difference in the size of the tumor, the depth of the cavity is now 5 instead of 7 inches. The patient says that she is better than she has been for a number of years.

March, 1888.—Unfortunately it was necessary for this lady to live in Brighton, although we warned her before she went that there would be almost certainly an increase in the amount of hemorrhage. The result which had been anticipated happened, and the lady came back not nearly so well as she had

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been. The last period was, however, much better, and confined her to bed for but two days.

May 28th.—"I have been waiting to tell you how I got over my next bad time, and I have not had one at all! and am feeling so wonderfully well that I do not believe that you would know me."

CASE LXXXVI.—Single, age 32; was sent by Dr. Matthews Duncan, in May, 1888.

Six years ago a tumor was first noticed in the abdomen, and the patient has been under medical treatment since that time. She has paid two visits to Kreutznach and one to Woodhall Spa, and thinks that the "cures" at those places perhaps did her a little good.

She complains of debility with its accompanying distresses. This is due, in great measure, to a constant watery discharge, so profuse as to make the constant wearing of a napkin necessary. There is also a greatly increased loss at the monthly periods, and she is in bed at that time for four days. There are also occasional attacks of pain in the tumor, which, as a rule, swells greatly before menstruation.

Three or four years ago an operation was performed for the cure of the disease. The nature of the operation neither the patient nor her mother can tell. After it, the patient was very ill, apparently from septic absorption.

The patient is very bloodless, and looks weak and ill. She says that for some years the legs have been swollen, and that the swelling is not away when she gets up in the morning.

On examination of the abdomen, there is seen to be quite a considerable amount of œdema beneath the skin. The tumor is very soft, and extends to within one finger's breadth of the ribs. The cervix is far back in the pelvis, and the cavity of the uterus measures eight inches.

The treatment was begun in May, but after seven applications, the patient became very home-sick and returned to Ireland. In August she came back, and thirty-nine additional applications were made. The sound was always attached to the positive pole.

May 3d, 100 ma. 5th, 150 ma. for 5 minutes each. There was some pain in the afternoon of the 3d. 7th, 175 ma. for 5 minutes. The patient says that she feels better, and that there is less of the discharge. 9th, 250 ma. 11th, 240 ma. for

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5 minutes each. The leucorrhœal discharge is as bad as ever. 14th, 240 ma. 22d, 130 ma. for 5 minutes each. There has been a better period than usual.

August.—Since going home the patient says that she has been very ill. Now she looks better than when she left town in May, and the tumor is smaller. 11th, 100 ma. 13th, 125 ma. 15th, 115 ma. 17th, 105 ma. 18th, 100 ma. 21st, 120 ma. 23d, 170 ma. 25th, 155 ma. 27th, 175 ma. for 5 minutes each.

September 3d, 180 ma. for 5 minutes. This period has not been a bad one, and the patient says that she feels stronger. 5th, 170 ma. 7th, 150 ma. 8th, 120 ma. 13th, 140 ma. for 5 minutes each. There has been rather more loss during this period, and the interval was shorter. 15th, 140 ma. 17th, 140 ma. 19th, 130 ma. 21st, 145 ma. 28th, 225 ma. for 5 minutes each.

October 1st, 200 ma. 3d, 160 ma. 5th, 150 ma. 8th, 140 ma. 11th, 160 ma. 13th, 150 ma. 15th, 135 ma. 17th, 160 ma. 22d, 145 ma. for 5 minutes each. The interval between the periods has been longer, and there has not been a greater discharge than last time. 24th, 155 ma. 26th, 160 ma. 30th, 165 ma. for 5 minutes each.

November 1st, 160 ma. 3d, 160 ma. 5th, 180 ma. 7th, 130 ma. 10th, 135 ma. 12th, 160 ma. 19th, 160 ma. for 5 minutes each. There has been rather less flow, and the patient's friends say that they notice a great change for the better. 21st, 160 ma. for 5 minutes. The tumor is now barely up to the umbilicus, and the patient is, in every way, better—less discharge, stronger, and the legs do not swell so much. Extract from letter, dated 15th January, 1889, "I suppose you expected to hear from me before this, and I would have written, but there was not much improvement. I am charmed to tell you now she is much better. She is just over her period, and has not been half as bad as the last time; but the watery discharge continues much the same; for all that she feels stronger.

"All our friends here are quite delighted to see such an improvement in her. The tumor has got much smaller, and her feet do not swell as much as they did when we were in London."

Dr. Ford, of Waterford, wrote in June to say that the lady was losing ground, and sent her to London again in July. She looked fairly well, with red lips; and on examination it was

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found that the tumor had not increased in size, but was fully as small as it had been in November of last year. There was, however, very marked œdema of the legs and also of the abdominal wall. The urine was found to contain about one-twelfth albumin on boiling and adding nitric acid.

CASE LXXXVII.—Single, age 45; was seen with Sir Spencer Wells in the beginning of March, 1888.

The tumor had been a trouble and annoyance for many years, and of late had become of such a size, that the lady could not sit with any comfort, and the general health was becoming broken down. The patient was so anxious to gain some relief that she started off to Edinburgh without sending word, and arrived there the day after we had left for London.

On examination, the tumor was found to entirely fill the abdomen, reaching up to the ribs. It was particularly hard, and there were several pediculated masses on the surface. The cervix was not to be felt from the vagina, the whole of the pelvis being filled by the lower part of the tumor.

May 8th, 1888, 25 ma. 10th, 45 ma. 14th, 100 ma. 16th, 110 ma. for 5 minutes each. There was considerable pain in the evening after the last application. 28th, 90 ma. for 5 minutes. The period has been much as usual. The tumor is more movable. 30th, 125 ma. for 5 minutes.

June 2d, 140 ma. 4th, 150 ma. 6th, 160 ma. for 5 minutes each. After this application there was a feverish attack, due probably to the use of strong negative doses in a delicate subject.

July 23d, 85 ma. for 5 minutes. The lady is to go out of town for the autumn, and expresses herself as feeling much more comfortable. Dr. Harper, who usually attends her, thinks that the tumor is smaller by one-quarter. On each of the ten applications the tumor had to be punctured, and the needle was made negative.

CASE LXXXVIII.—Single, age 43.

For four years or so the patient has been aware that she had a tumor. It varies greatly in size, being very much swollen before the periods. Sometimes only, there is a flooding, but there is great discomfort and uneasiness, and the lady cannot walk far—indeed for a long time she has not walked beyond her garden.

The tumor, after the period is over, extends up to the navel.

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The cervix is small, and is situated far back. In front and pressing on the bladder is a mass of tumor. The sound passes backward, then to the left, and finally sharply forward to a depth of three inches.

May 10th, 1888, 70 ma. 12th, 70 ma. 14th, 75 ma. 16th, 70 ma. 18th, 55 ma. 21st, 80 ma. for 5 minutes each. As the period was coming on to-day, a change was made from the negative to the positive sound. The patient is more comfortable than usual at this time. 28th, 35 ma. for 5 minutes. A fairly good period. The patient is sleeping better, and she says that the tumor is smaller than it has been for a long time. 30th, 55 ma. for 5 minutes.

June 1st, 50 ma. 4th, 65 ma. for 5 minutes each. Is feeling very well, and the tumor continues to decrease in size. 6th, 8th, and 11th, 50 ma. for 5 minutes. 13th, 55 ma. for 5 minutes. The tumor is decidedly swollen to-day. 15th, 55 ma. 18th, 50 ma. 20th, 50 ma. 22d, 55 ma. for 5 minutes each. Feels uncomfortably swelled. 25th, 55 ma. for 5 minutes. A very light menstrual period has been followed by great comfort and diminution in the size of the tumor. 30th, 50 ma. for 5 minutes.

July 2d, 90 ma. for 5 minutes. Even on deep pressure the tumor cannot be felt from the abdomen. 4th, 75 ma. 6th, 65 ma. 9th, 70 ma. 11th, 70 ma. 13th, 65 ma. 16th, 60 ma. 18th, 65 ma. 20th, 65 ma. 23d, 65 ma. for 5 minutes each. In every way is much better.

July 5th, 1889.—"I have not written to you since December for I have had no time, and have had a terrible time of suffering and anxiety and nursing, which ended last month. My youngest sister died after many months of suffering. I have nursed her night and day. Since the beginning of January till 7th June I have been only four nights in bed! I am sure I should never have got through this last six months had it not been for your treatment last summer."

CASE LXXXIX.—Married, age 45; was seen in consultation with Dr. Easton in May, 1888.

The history dated back to eleven years ago, as it was about that time that attention was drawn to the presence of an abdominal tumor, by occasional attacks of pain. Now, the lady says that she has not been free from pain for some years, and she cannot express how much the abdominal discomfort

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and feeling of weight oppress her at all times. Indeed, she is so miserable that she often wishes that death might put an end to her suffering, for she has not any pleasure in living. She sleeps badly. She has always cold feet. At the periods all her pains and discomforts are greatly increased, and she loses more than she used to do, though there is really never much hemorrhage. At these times she is confined to bed for three or four days, and is never able to get up in the mornings, though naturally she is a very active woman. Some three or four years ago, she had a bad attack of phlegmasia dolens, and has never entirely lost the swelling of the leg. At the age of 42 a well-known abdominal surgeon was consulted. His opinion seems to have been very much against the probability of recovery, if an attempt had been made to remove the tumor.

The lady had tried everything that offered any hope of relief; she had spent two years at Kreutznach and the Riviera, and came home rather worse than better; she had also undergone a very painful course of treatment in a sort of vapor electrical bath, also without relief, and she thinks with decided increase in symptoms. She looks ill and worn, and there is great disfigurement.

On examination the tumor is found to be enormous; it is very hard and prominent, and extends up underneath the ribs, evidently for a long way, as the chest wall is very much raised. It is not possible to get even the tip of the finger between the tumor and the ribs or sternum. No measurements were taken until after the treatment was ended in the beginning of August, and at that time the lady found that she measured 35 inches. As she is slightly made, she ought to be probably about 22 or 23. The cervix was large, lacerated, and situated in the hollow of the sacrum.

The treatment was commenced with really little hope of benefit on the part of the patient and her friends, and consisted of the passage of the continuous current on thirty occasions. During eight of these operations the sound was made positive.

May 15th, 1888, 100 ma. 17th, 100 ma. 19th, 75 ma. 21st, 90 ma. for 5 minutes each. June 4th, 75 ma. for 5 minutes. There has been more flow and more distress than usual, during the period which is passed, and to-day the tumor seems to be very prominent at the upper part. 6th, 85 ma. 8th, 100 ma.

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for 5 minutes each. The tumor is perhaps a little less hard than it was. 11th, 100 ma. 13th, 110 ma. for 5 minutes each. As it is nearly the time of the period, the sound was made positive. The tumor is not quite so tightly fixed under the ribs. 15th, 100 ma. 19th, 100 ma. 21st, 110 ma. 25th, 110 ma. for 5 minutes each. The application was made to-day at the lady's house, as the period is not quite over. Though the discharge has been free, she feels better than she usually does about this time. 27th, 135 ma. for 5 minutes. A marked lessening in the size of the tumor is noted to-day, and the patient feels decidedly more comfortable. 29th, 135 ma. for 5 minutes.

July 2d, 100 ma. 4th, 100 ma. 7th, 105 ma. 9th, 125 ma. 11th, 100 ma. 13th, 125 ma. for 5 minutes each. There is less heartburn, and on the left side there is a distinct depression between the chest wall and the tumor. The patient is able to sleep better. 16th, 135 ma. 18th, 125 ma. for 5 minutes each. The period has just begun. The tumor has never been so small, and there is a depression between it and the sternum, as well as on both sides. 23d, 125 ma. for 5 minutes. The period has been much as it used to be before the treatment was begun. 25th, 120 ma. 27th, 110 ma. 30th, 110 ma. for 5 minutes each.

August 1st, 110 ma. 3d, 125 ma. 6th, 115 ma. for 5 minutes each. The tumor is quite free of the ribs, and does not seem to be half the size it formerly was.

Extract from letter, dated 28th September.—"Just a few lines to tell you I have returned from North Wales, and am feeling much better and stronger than when you saw me last, early in August. I have had two severe periods, which weakened me for the time; but I have been very free from pain, and can sleep so much better. My friends here say I am looking so different, and I feel I have gained so much in nerve lately. I can also walk better, and the veins have not been so troublesome."

December 7th.—"I cannot express all the gratitude I feel for my improved health. I am glad to tell you that I am slightly smaller since I saw you, and find I am 29 inches only round the waist—in August I measured 35 inches, so I am really now not at all remarkable in figure, and much more comfortable."

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July, 1889.—The lady is not so well as she was in December last, and has still a great deal of discomfort during the periods. The tumor is also larger than it was at that time. In every way she is better than she was eighteen months ago, but we propose to further reduce the size of the mass by some treatment.

CASE XC.—Single, age 36; was sent by Dr. Lett, of Wakefield, in May, 1888.

For ten years there has been an excessive loss of blood at the periods, and eight years ago the tumor was first noticed. The periods last six days usually; for two of these the loss is very great, and the patient is confined to bed for two or three. Sixty or seventy diapers are always required. As the flow ceases there is great sickness accompanied by pain, and for this she has required to have hypodermic injections of morphia for two or three days every month. Between the periods there is an almost constant and profuse leucorrhœal discharge, and the lady is seldom dry for even a few hours together.

As far as strength goes, she can walk well, but even on level ground she cannot go far, as severe palpitation is set up.

The patient is seen to be terribly anæmic, and on examining the abdomen the tumor, which is not specially prominent, is found to extend up to well under the ribs and sternum. The sound passes fully 6 inches.

Dr. Lett writes that the tumor has been growing more rapidly of late. Everything in the shape of drugs has been tried without any permanent effect, with the exception of the morphia, which is required for the sickness.

The treatment consisted in thirty positive applications.

May 18th, 40 ma. for 5 minutes.

June 12th, 80 ma. for 5 minutes. A severe cold has prevented anything being done for the last three weeks. In the mean time, the period has been got over rather more easily than usual. 14th, 85 ma. 16th, 95 ma. 19th, 85 ma. for 5 minutes each. The patient thinks that she begins to feel a little better and stronger. 21st, 110 ma. 23d, 135 ma. 25th, 110 ma. 27th, 125 ma. for 5 minutes each.

July 11th, 85 ma. for 5 minutes. The period this month has been better in every way—less hemorrhage, pain, and sickness; and it was five days later than it should have been. 13th, 100 ma. 17th, 75 ma. for 5 minutes each. There was an

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attack of diarrhœa yesterday, and to-day the tumor is tender to the touch. 19th, 110 ma. 21st, 135 ma. for 5 minutes each. There is seldom any palpitation while walking on level ground now. 23d, 135 ma. 25th, 120 ma. 27th, 80 ma. for 5 minutes each.

August 4th, 95 ma. for 5 minutes. There has been as much flow as last time, but unaccompanied by sickness and palpitation. The patient feels stronger, and has a little color. 6th, 90 ma. 11th, 115 ma. 13th, 85 ma. 15th, 110 ma. 17th, 120 ma. 21st, 120 ma. for 5 minutes each. The lady is very well, and goes to the seaside for a month, so as to have a change before the summer is over.

September 27th, 90 ma. for 5 minutes. There was so little pain at the last period that only one morphia pill had to be taken. The quantity of discharge was rather more than half what it used to be before the treatment. 29th, 100 ma. for 5 minutes.

October 1st, 80 ma. 3d, 75 ma. 5th, 100 ma. 8th, 90 ma. for 5 minutes each. The patient says that she feels quite well, and able to do anything.

Extract from letter dated 28th August, 1888: "I think I have a very good report to give of myself on the whole. I began as usual two days too soon, and the hemorrhage seems to be the stubborn point with me. The first two days I thought I was going to be wonderfully better in that respect, but it went on longer, and consequently I don't think I had any less than the time before. In every other respect I am very much better. No morphia injected (I think I have only been without it about three times in eight years). No sickness; certainly decreasing in size, indeed 'getting a figure,' and, of course, less weakness afterward. I think I have got nearly as much faith in electricity now as you have."

September 24th, 1888.—"I have nothing but good to report."

November 21st, 1888.—"I have not any rapid progress to report, but on the whole it is fairly satisfactory, I think. The last period I had a little more in quantity than the time before. Last time I had about fifty-six diapers, the time before about forty-three; but that is the worst point in my case. The pain keeps marvellously better, and I have not had any morphia injected. Each time I had two or three little pills

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with morphia, which was quite enough to check the pain I had. It does not continue as it did either, only as a rule lasting a few hours—about twenty-four after I have begun. Dr. Lett measured me after I had got over the worst, and he found me 4 inches less than I was. Everything but the hemorrhage seem to be going on satisfactorily; that, of course, is still more than it should be. I feel very well in between."

On 10th December Dr. Lett wrote: "Her periods are much better—fairly free from pain and nausea—but the hemorrhage is still excessive. Internal remedies have been all tried, and failed."

On the 15th February, 1889, we had the following account: "Miss ——'s last few periods have been marked by nausea, continuing from the second day for six or seven days; also neuralgic headache, the effect apparently of anæmia. I think the hemorrhage last time was not in the aggregate so profuse as in the old days before you saw her; but last time it was very profuse indeed during twelve hours. I suppose the total number of 'changes' is one-quarter less, but the constitutional effect is not less. Pain is now quite trifling.

"The last period but one was peculiar. After a fair beginning, she felt nearly well about the fourth day, and got up and about—all the time with nausea and a feeling of 'not getting well nicely;' occasionally passing a small elongated clot, with nearly white discharge between. When I saw her she was decidedly ill, and was sent to bed. Next day there were pain and tenderness over the tumor, especially at one circumscribed spot, above and in front, where I found fluctuation (this has gone). Temperature, 102.2°; pulse, 124; and vomiting. Very like metritis. She was not perfectly free from occasional pink discharge for a fortnight after the beginning of menstruation, and the next (the last) period began five weeks after the other. One week late for the first time in her experience."

The patient was seen again on the 16th February, and it was decided to wait for at least one other period before doing anything more. The tumor did not extend up to the ribs at any point.

March 9th, 1889.—"I believe in electricity! Here is my report. I came from Eastbourne feeling splendid, and looking a new creature. My period came on on Monday morning; pain

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soon subdued; no sickness; and only thirty-six diapers in all; and four days only it lasted. It went yesterday morning. I have stayed in bed, for I have feared to spoil the record. I do believe now I shall go on to perfection. My body is perfectly soft and natural."

May 8th.—Since the last note there has been but one period after an interval of seven weeks. There was not any pain, and the loss was comparatively little, not more than twenty diapers being required, and the lady was going about the whole of the time. She says that she is perfectly well, and that the tumor is becoming smaller.

CASE XCI.—Single, age 40; was first seen in May, 1888.

The history dated back to two years ago, when the lady finds that she had noted down that she was losing more blood at the monthly periods than was habitual with her, and that instead of lasting seven days the flow continued for nine. Eight months ago the tumor was first noticed, and during the last two months it has been growing with great rapidity. Lately there has been a painful tired feeling across the back and discomfort in the right leg and hips. For a week or so before the appearance of the menstrual flow, the patient is much troubled by flatulence and discomfort after eating. It is not, however, so much on account of the present symptoms that the patient is anxious to have some treatment, but is owing chiefly to having seen the great suffering, which these fibroid tumors of the uterus may cause, in the person of an older sister, who has quite lately undergone a six-months' course of electrical treatment, apparently after Apostoli's method. This sister is improving; but as the treatment and the menopause came about the same time, it is probable that the latter has as much to do with the improvement as the former.

The tumor reaches up to the margin of the ribs all round, and is decidedly prominent.

May 25th, 1888, 100 ma. 28th, 110 ma. 30th, 120 ma. for 5 minutes each.

June 2d, 120 ma. 4th, 130 ma. 6th, 150 ma. for 5 minutes each. The tumor appears to be rather smaller, and there is scarcely so much dyspepsia as usual about this time. 16th, 125 ma. for 5 minutes. There has been more flow than usual, and accompanied by more pain; the usual headache has not

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been so bad. 18th, 130 ma. 20th, 110 ma. for 5 minutes each. The tumor is now quite free of the ribs. To-day the internal sound was made negative instead of positive, as it has been before. 22d, 140 ma. for 5 minutes.

July 2d, 100 ma. for 5 minutes. There has been more than the average amount of bleeding. 11th, 90 ma. 13th, 110 ma. 16th, 135 ma. 18th, 110 ma. for 5 minutes each. The tumor is smaller, and the patient is more comfortable. 20th, 125 ma. 23d, 120 ma. 25th, 120 ma. 27th, 110 ma. for 5 minutes each.

August 13th, 85 ma. for 5 minutes. In every way the period has been better, and the patient feels well. 15th, 105 ma. 18th, 105 ma. 22d, 100 ma. 28th, 125 ma. for 5 minutes each. The period has been much the same as the last. 30th, 125 ma. for 5 minutes.

September 1st, 125 ma. 3d, 145 ma. 5th, 125 ma. 7th, 125 ma. 16th, 125 ma. for 5 minutes each. The tumor extends to barely 2 inches above the umbilicus, and does not reach more than 3 inches to the left of the middle line.

March, 1889.—At first the patient was in every way much better, but for the last two months there has been much more discomfort, with a return of the old symptoms. The tumor is larger than when seen some months ago, and reaches to fully 3 inches above the umbilicus. 5th, 60 ma. 7th, 100 ma. 9th, 90 ma. 11th, 100 ma. 13th, 100 ma. 15th, 110 ma. 18th, 120 ma. for 5 minutes each.

April 2d, 100 ma. for 5 minutes. The period has been very much as usual. 4th and 6th, 105 ma. for 5 minutes. 8th, 105 ma. 10th, 110 ma. 12th, 125 ma. for 7 minutes each. In the mean time the treatment is to be discontinued, but will probably be recommenced later on.

Case XCII.—Married, age 59; was seen with Dr. Robson Roose.

This lady has suffered for many years from constipation. She has tried every known drug and every known method of treatment, and nothing has ever been of the slightest service, and the bowels are now moved with great difficulty by the help of very copious injections. Dr. Allan, of Brighton, was the first to suggest that the original cause of the constipation might have been the presence of an uterine fibroid, which had never apparently given rise to any trouble. Dr. Roose concurred, and the lady was willing to try the experiment, and

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have the tumor reduced in size. It was determined to make fifteen negative applications, and to wait and see if there were any improvement before continuing with the treatment.

The tumor itself was of stony hardness, and was situated in the left side, extending up to 2 inches above the level of the anterior iliac spine. It was absolutely immovable, and appeared to be almost continuous with the iliac bone. From the vagina, also, not any movement could be felt.

June 6th, 1888, 50 ma. 8th, 65 ma. 11th, 75 ma. 13th, 75 ma. 15th, 100 ma. 18th, 100 ma. 20th, 115 ma. 22d, 135 ma. 23d, 135 ma. 25th, 115 ma. 27th, 130 ma. 29th, 135 ma. 30th, 135 ma. for 5 minutes each.

July 2d and 3d, 150 ma. for 5 minutes. The tumor is now up to the level of the anterior iliac spine, and is not quite so fixed.

November.—Although the constipation has not improved, both the lady and her doctor wish to repeat the course of treatment, as there has been a marked improvement in the condition of the tumor. It is now quite separate from the bone, and the patient's masseuse has remarked that there is now a hollow between the ilium and the tumor. 9th, 85 ma. 10th, 90 ma. 12th, 70 ma. 13th, 75 ma. 15th, 140 ma. 17th, 125 ma. 19th, 125 ma. 20th, 135 ma. 23d, 125 ma. 24th, 125 ma. 26th, 110 ma. 27th, 130 ma. 29th, 120 ma. for 5 minutes each.

December 1st, 125 ma. 3d, 145 ma. for 5 minutes each. The tumor is now freely movable. It does not reach up to within 2 inches of the level of the anterior iliac spine, and the hand can be passed between it and the tumor.

June, 1889.—The general health is much improved.

Case XCIII.—Married, age 45; was sent by Dr. Matthews Duncan.

The patient had suffered for several years from gradually increasing debility, due chiefly to the presence of a small fibroid tumor of the uterus, which gives rise to excessive losses at the periods.

The fundus was found to reach to 2 inches above the pubes, and it was difficult to introduce the sound on account of the position, and also to a flexion of the cervix.

June 2d, 1888, 50 ma. 14th, 50 ma. 16th, 50 ma. 19th, 60 ma. for 5 minutes each. The lady is rather better, and her

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maid says that she is certainly stronger. 21st, 55 ma. 23d, 65 ma. 25th, 75 ma. for 5 minutes each. There has been a decided improvement in the general condition. 27th, 75 ma. 29th, 55 ma. for 5 minutes each.

July 10th, 65 ma. for 5 minutes. The period has been much better than usual. 13th, 60 ma. 16th, 60 ma. 18th, 50 ma. 20th, 50 ma. for 5 minutes each.

The lady was very anxious to get out of town, and was to come back to renew the treatment if she did not continue to improve. She was never able to bear a strong current, and it will be observed that the average strength of the fourteen applications was scarcely 60 ma. In every case the sound was made positive.

CASE XCIV.—Single, age 47; was seen first in June, 1888.

The history may be best given in the patient's own words: "After six or seven years of excessive hemorrhage and rather quick periods, I had very violent discharges with very large clots, and on March 31st, 1886, Dr. Godson was telegraphed for, and he plugged me. During the remainder of that year I had regular but excessive periods, and was in bed a week each time. During 1887 much longer times of hemorrhage, and seldom free more than three or four weeks. During the last Christmas holidays I was only out of my room seven times in four weeks. From January 15th to May 15th I have spent about eight weeks in bed or on my couch, and now I am getting bad again."

The patient is a big-made woman; decidedly anæmic. She says that she cannot walk farther than a hundred yards, partly on account of weakness, and partly from a very severe pain in the back, which walking or driving sets up.

On account of the thickness of the abdominal wall, it is not easy to feel the tumor, which, however, extends up to above the umbilicus. The sound passes 5½ inches, and the cavity is large from side to side.

June 14th, 1888, 75 ma. 16th, 80 ma. 19th, 85 ma. 21st, 75 ma. 23d, 85 ma. for 5 minutes each. Is a little stronger, and has not quite so much backache. 25th, 85 ma. 27th, 85 ma. 29th, 90 ma. for 5 minutes each.

July 2d, 90 ma. 4th, 100 ma. 6th, 95 ma. for 5 minutes each. Friends notice that the patient is looking much better. 9th, 100 ma. 11th, 100 ma. 13th, 100 ma. for 5 minutes each.

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To-day was the first application, after which there was not any backache; and yesterday the lady had what she now considers a good long walk. 16th, 100 ma. 18th, 110 ma. 20th, 90 ma. 23d, 125 ma. 25th, 110 ma. 27th, 125 ma. 30th, 130 ma. for 5 minutes each.

August 1st, 115 ma. for 5 minutes. Yesterday the lady walked farther than she has been able to do for the last two and a half years. 3d, 115 ma. 11th, 110 ma. for 5 minutes each. The red discharge lasted for one day only, and was followed by a profuse leucorrhœal flow. There was little discomfort, and the tumor is smaller. 13th, 115 ma. 15th, 95 ma. 17th, 120 ma. for 5 minutes each. There is some decidedly fœtid discharge. On the 23d inst. a mass, described as looking like a piece of tumor, came away, and this was followed by rapid improvement both in the quantity and character of the discharge.

Extracts from letters:

September 17th.—"I have been waiting to report myself until I could send a clean bill of health. I think I may do so now, as I feel better in every way, and have only a little white discharge. Of course I feel pretty tired by the time evening comes."

November 13th.—"I had seven such good weeks—so well and comfortable—able to get up and down stairs each day. I was waiting then to write to you until some sort of period came. On the 2d there was a small commencement, and the next three days still quite a normal quantity. I ventured out, and in the evening I had pain, deluge, and two clots; next day rather violent too. Thursday—I syringed away two clots. Friday—a little better. Saturday—twelve hours of acute backache; and on Saturday night such a hemorrhage, all through Sunday and Monday. To-day—decreasing; but, instead of being clear, bright red, it is muddy and offensive. Disappointing, isn't it?"

March 4th, 1889.—"I am recovering from another terrible time of tribulation. I had a quiet, normal sort of period toward the end of January; and after a few days I had the most terrible pains, all around my loins and nearly down to my knees, lasting many hours at a time. It was so acute that it seemed as if all the veins and muscles in those parts were being tightly drawn out. This was all accompanied by great

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lumps of discharge, and lasted two and a half weeks (from 2d to 20th of February), and then I began to get better. I had to get my doctor several times. I could not bear the pain. He gave me opium pills."

May 13th.—The last period has been very much better, and the patient feels now that she is making progress. The tumor is about one-third less than it was before treatment.

CASE XCV.—Married, age 27; was first seen in July, 1888.

This lady was not aware that there was anything the matter with her pelvic organs, until she had a miscarriage a year ago. Since that time, there has been more flow at each succeeding menstrual period, and there is also more or less pain complained of in the left side. She has come home from South America for a few months, and is most anxious to be made quite well before she returns, more especially as she is very much troubled with asthma. A month or six weeks ago the tumor was examined both by a practitioner in the country, and by the obstetric physician of one of the large hospitals. Both of those gentlemen passed a sound, and both found that it entered to a depth of 4½ inches. We found that a sound passed 6 inches, so that the tumor either was growing with great rapidity, or what is more likely is, that measurements made by different people, or even by the same person at different times, cannot always be relied on. The sound appeared to have entered as far as it would go at 4½ inches, and then by a little manipulation it was found that the direction of the cavity changed, and that the sound passed for another inch and a half. This shows the fallacy of insisting on a reduction in the size of a cavity before a satisfactory result can be claimed. The tumor, immediately after menstruation, extended up to 1 inch above the umbilicus.

As the lady's time in this country was short, she went out visiting and to theatres, exactly as she would have done had she been quite well. A greater number of applications than the average were made, simply because the patient had so far to go home, and could not have more of the treatment if required. There were in all thirty-eight, the sound being attached to the positive pole of the battery.

July 7th, 1888, 100 ma. 10th, 120 ma. 12th, 120 ma. 14th, 135 ma. 17th, 135 ma. for 5 minutes each. The tumor is smaller than it has yet been. 19th, 145 ma. 21st, 175 ma.

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23d, 170 ma. 25th, 150 ma. 28th, 150 ma. for 5 minutes each. The period has been bad for only two days. 31st, 135 ma. for 5 minutes.

August 2d, 130 ma. 6th, 110 ma. 14th, 100 ma. for 5 minutes each. There has been a good deal of colicky pain in the womb for the last few days. 16th, 100 ma. 18th, 120 ma. 21st, 105 ma. 23d, 120 ma. for 5 minutes each. The period is just on, and the tumor has not swelled up to as high as the umbilicus. 25th, 105 ma. 28th, 135 ma. 30th, 135 ma. for 5 minutes each. The lady feels very well, and the tumor continues to decrease.

September 4th, 120 ma. 6th, 140 ma. 8th, 135 ma. 11th, 110 ma. 13th, 135 ma. 15th, 125 ma. 18th, 120 ma. 22d, 120 ma. for 5 minutes each. The period is over; there was not so much, but there were clots. The tumor has never been noticed to be so small as it now is. 25th, 120 ma. 27th, 130 ma. for 5 minutes each.

October 2d, 150 ma. 4th, 120 ma. 6th, 125 ma. 9th, 115 ma. 11th, 115 ma. 13th, 110 ma. 20th, 120 ma. for 5 minutes each. The period has been much the same as the last. The cavity measures 5 inches. At about 4 there is the obstruction which has always been felt.

The lady went home to South America, and wrote on January 17th, 1889, "I think, on the whole, I may say I am fairly well, though I must confess that such a complaint as mine is a decided 'thorn in the flesh,' and gives me a good deal of inconvenience and pain. In December I was certainly better; but this month I had a bad time, so naturally feel somewhat depressed."

At the end of three months or so, it is not at all uncommon to get an account such as this.

Case XCVI.—Single, age 44; was first seen with the late Dr. Sidey some years ago.

When about the age of 32, it was noticed that the losses every month were increasing, and eight years ago the lady first became aware of the presence of a tumor in the abdomen. For a great many years there has been a very bad pain in the right side, and at times the flooding and the pain have both been so severe that the patient did not dare to move, and only obtained relief after a three-quarter-grain dose of morphia had been injected under the skin. There were several reasons

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which prevented this lady seeking relief by operation, though she was often almost forced to have something done. Two years ago she was sent to Spain for several months, and returned very much improved in every way—less pain, less hemorrhage, and stronger generally. This improvement was, unfortunately, of a temporary character, and before long the lady was back again to the old condition of anæmia and weakness.

In July, 1888, the tumor was found to extend to two inches above the umbilicus. It was very prominent, and on the right side it extended very far back into the loin, and appeared to be immovably fixed in that position. The tumor filled the whole of the pelvis, coming quite low down. There was no cervix, and the os uteri was felt to be situated rather more in front than usual. The cavity was large, but it appears that its exact depth was never recorded.

The treatment consisted in twenty-five applications, during all of which the sound was made positive.

July 24th, 26th, and 28th, 1888, 80 ma. for 5 minutes.

August 1st, 85 ma. 3d, 85 ma. 6th, 80 ma. 11th, 95 ma. for 5 minutes each. After every application there is a very considerable amount of backache complained of for several hours, and it is worthy of note that though this lady was able to suffer great pain without making much complaint, yet she could not stand a strong current of electricity. The tumor is smaller and is somewhat movable. 13th, 85 ma. 15th, 120 ma. 17th, 75 ma. 20th, 125 ma. 23d, 130 ma. for 5 minutes each. The tumor has partly rotated; there is now some slight appearance of a cervix, which is situated rather farther back in the pelvis than natural. On account of the altered position of the tumor, the patient was assured that she would not have any backache. 25th, 150 ma. for 5 minutes. There was not any backache after the last application. The tumor does not reach up to the umbilicus, and has become lobulated. 27th, 115 ma. for 5 minutes. The tumor appears to have become smaller in the last two days, and instead of there being a mass fixed in the right side, that flank is now entirely free of tumor. 31st, 75 ma. for 5 minutes. Menstruation has come on freely, and for the first time for many years there has been neither pain nor sickness; and, although the sickness usually prevents the patient taking food for three days, she has not missed a meal.

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September 10th, 100 ma. for 5 minutes. On the 1st of the month, the lady, thinking that the period was over, went out for a walk, but had not gone far, when she was seized with a severe pain in the tumor, and had to drive home at once. The flow returned, and on two occasions morphia had to be injected. 12th, 14th, and 17th, 100 ma. for 5 minutes. 19th, 80 ma. for 5 minutes. 21st, 50 ma. for 10 minutes. 29th, 65 ma. for 5 minutes. The loss has been decidedly great, but unaccompanied by either pain or sickness.

October 1st, 115 ma. 3d, 140 ma. 5th, 100 ma. for 5 minutes each. The tumor is now less than half the size it was in July. 6th, bleeding came on during the night, and was accompanied by severe pain. 9th, the hemorrhage has been very profuse, and morphia has had to be injected four times. The tumor has been steadily swelling up, and is to-night as large as it was before the commencement of the treatment. 10th, the patient woke about four A.M., and found to her astonishment that the tumor was not half the size it had been when she went to sleep, although there had been less discharge, and no clots had been passed. 18th, went home to Edinburgh, looking certainly more ill than she did, when she left it three months before.

After getting home there were two bad periods. By the 21st January, 1889, she was able to write, "It means a different life for me, what you have done."

April 13th.—"Every day I announce to myself that it is a miracle—no more and no less. I am perfectly well, gradually getting quite active, and have a permanent color. I think there have been two periods since New Year, but so slight that I scarcely recognize them as such. Before the last, the tumor had got very small; then at the period it was distended a little, but is beginning to go down again. Its being distended was about the only thing by which I knew it was a period. You remember what an object I was at the end of the treatment, and now I think I am just as much the other way."

May 3d.—Looks splendidly well, and says that it is at least twelve years since she felt as she does now, and tells me that she has been working hard all winter.

CASE XCVII.—Married, age 45; came over from Boulogne in the beginning of August, 1888.

This patient had always been a fragile, delicate woman, and

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for twenty years has been unable to live in England on account of bronchitis, asthma, and occasional attacks of pleurisy.

For some eight or ten years there has been menorrhagia, which had been increasing steadily year by year. Six years ago, the tumor was first noticed, and it is slowly growing larger and larger, and is now, she thinks, beginning to affect her breathing. The periods last, as a rule, for fourteen days, and the increased flow is a serious drain under the circumstances, though a strong woman would not be much affected by it. A frequent desire to pass water is also much complained of.

The tumor extends to 2 inches above the umbilicus, and descends very far into the pelvis, and presses on the bladder. There is not any cervix, and the os is reached with some little difficulty. The whole of the right side of the abdomen is tender.

August 3d and 6th, 50 ma. for 3 minutes. 13th and 15th, 45 ma. for 4 minutes. 25th, 70 ma. for 5 minutes. The period is over, and has been very much the same as usual. 27th, 60 ma. 29th, 60 ma. 31st, 55 ma. for 5 minutes each.

September 3d, 65 ma. 5th, 70 ma. 7th, 70 ma. for 5 minutes each. There is perhaps a little improvement in the general condition, and the tumor is certainly smaller. 10th, 65 ma. 12th, 55 ma. 20th, 75 ma. for 5 minutes each. The period has been again much the same. 22d, 60 ma. 27th, 55 ma. for 5 minutes each. There has been a great deal of pain complained of in the tumor. 29th, 80 ma. for 5 minutes.

October 1st, 60 ma. for 6 minutes. There has been a marked improvement in comfort in the last few days. 3d, 65 ma. 5th, 80 ma. 8th, 65 ma. 16th, 70 ma. 18th, 70 ma. for 5 minutes each.

There was not any improvement in the period this month in the amount of hemorrhage. The tumor is now barely up to the umbilicus, and is fully one-third smaller than it was. The lady fears to remain in London longer, and goes to Falmouth for the winter.

November 27th.—"You may possibly be expecting a report from me of myself, but I really have nothing good to say. After I came here, the period came on, nine days too soon, and the next time, fifteen days too soon, and it has not ceased at all, nor seems likely to do so. The loss has been far greater than ever in my life."

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February 27th, 1889.—"Since I wrote you, nearly three months since, I have steadily grown worse—loss greater, period longer."

In April this lady came back to town, and the menstrual flow did not appear for five weeks, and the quantity was comparatively slight. An attempt was made to continue the treatment. The passage of the current could not be borne, unless while the lady was under the influence of morphia. Unfortunately, however, the action of the drug, which had to be given in large doses, was too depressing, and also caused considerable œdema of the lungs.

In May, there was a greater loss, but almost no pain, and it was considered advisable to send the patient to the country, as she is unable to be out of the house for the seven or eight cold months of the year.

The tumor is slightly larger than it was in October of last year; though still much smaller than it was before treatment.

CASE XCVIII.—Married, age 46; was seen with Dr. Straton, of Wilton, in August, 1888.

The patient had been aware of the presence of a tumor in the abdomen for about nine years. At first it gave rise to little or no inconvenience, but of late years it has caused a great deal of discomfort and pain. Within the last two months the growth has been so rapid that dresses have had to be let out six inches. The pain has been so acute on the left side for the last five or six weeks that poultices have had to be kept almost constantly to the part. There has not been any menorrhagia.

The tumor is a very large one, and its weight is probably nearer forty than thirty pounds. It is immensely broad from side to side, and extends very high up under the ribs and sternum, raising the thoracic wall enormously. The tumor extends deeply into the pelvis, and an enormous artery is felt close to the cervix, which is itself small, and situated well up on the right side. The cavity measures about 5 inches. The weight of the mass has prevented the patient taking much exercise, and since the rapid increase in size a couple of months ago, she has been scarcely able to walk.

The treatment consisted in thirty applications, in all of which the sound was made negative. The strength of current was never great, averaging slightly over 90 ma.

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August 4th, 6th, and 11th, 45 ma. for 5 minutes. Feels certain that she is stronger, and can move about rather more easily. 13th, 60 ma. 15th, 75 ma. for 5 minutes each. For the first time for fully two months the patient was able to go out for a short walk, and there is less pain. 17th, 85 ma. 20th, 55 ma. for 5 minutes each. There has been a decided increase in the amount of pain in the tumor, but unaccompanied by any inflammatory symptoms. 25th, 75 ma. for 5 minutes. There has been an easy period, with rather more discharge than usual. There is a marked decrease in the amount of bulging in the flanks; the patient can button a dress which was much too tight for her a couple of weeks ago, and there has not been any pain at all for two days. 27th, 95 ma. 29th, 95 ma. 31st, 100 ma. for 5 minutes each. The skin over the tumor is much less tense than it was.

September 3d, 110 ma. 5th, 125 ma. 7th, 100 ma. for 5 minutes each. The tumor is almost free of the ribs. 13th, 100 ma. for 5 minutes. There has been again rather a greater loss than usual. 15th, 130 ma. 17th, 110 ma. 19th, 100 ma. 21st, 115 ma. 24th, 110 ma. for 5 minutes each. The patient says that she feels very well, and the tumor continues to decrease rapidly in size. 26th, 100 ma. 28th, 110 ma. for 5 minutes each.

October 1st, 90 ma. 3d, 115 ma. 5th, 110 ma. 9th, 110 ma. 13th, 80 ma. 15th, 70 ma. 17th, 70 ma. 19th, 75 ma. for 5 minutes each. The tumor is not half the size it was, and the improvement in the general condition and appearance is so great, that a friend remarked, that surely the days of miracles had returned.

December 2d, 1888.—"I am sorry I cannot give a good report of myself. I am not nearly so well as when I left London; in fact, I have been obliged to spend most of my time in bed, as when I walk or move about I have such a bad dragging pain in the left side."

February 6th, 1889.—"I am pleased to tell you I am so much better than when I wrote last; in fact, the first fortnight of the month I feel quite well, and my stomach is so much smaller. For the next ten days it gets larger, with some pain in my left side; but each month there is less pain, and the tumor itself is much smaller."

May.—"I am pleased to tell you I feel much better and

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stronger in myself, and my stomach is much smaller three weeks at a time; but the fourth week it gets very large, and a good deal of pain; but every one says how much better I am looking."

CASE XCIX.—Single, age 39; was sent by Dr. Wilson, of Gateshead, in October, 1888.

For several years the general health had not been at all good, and increase of menstrual discharge led to the discovery of a fibroid tumor of the uterus three years ago. The patient says that she feels tired, if she exerts herself, even slightly, and that she has a constant feeling of fulness with discomfort and pain especially during menstruation. Sleeps badly. The tumor extends to two inches above the umbilicus on the left side, and on the right it almost touches the ribs. It is slightly irregular in outline. The tumor descends deeply into the pelvis, the cervix is far back, and the passage of the sound is not easy.

October 11th, 1888, 70 ma. 13th, 60 ma. 15th, 85 ma. 17th, 65 ma. for 5 minutes each. Is already sleeping better. 19th, 90 ma. 22d, 70 ma. for 5 minutes each. The lady thinks that the tumor is smaller, and she says that she feels better.

November 2d, 75 ma. for 5 minutes. There has been fully as great a loss as usual. 5th, 65ma. 7th, 75 ma. 9th, 85 ma. for 5 minutes each. The tumor is smaller and the lady feels stronger. 12th, 80 ma. 14th, 90 ma. 16th, 95 ma. 26th, 65 ma. for 5 minutes each. The period has been much easier than usual, and there has not been any headache. This has been, of late years, a constant accompaniment of menstruation. 30th, 80 ma. for 5 minutes.

December 3d, 95 ma. 5th, 80 ma. 9th, 70 ma. 10th, 70 ma. for 5 minutes each. On the left side in particular, there is a marked lessening of the tumor. 19th, 85 ma. for 5 minutes. The patient is in capital spirits, as she has had the best period for quite a number of years, and there has not been any headache. 21st, 100 ma. 24th, 80 ma. 26th, 80 ma. 28th, 70 ma. for 5 minutes each.

January 9th, 1889, 55 ma. for 5 minutes. There has been rather a greater flow of blood this time, but in spite of it, the lady feels very well. 11th, 60 ma. 14th, 70 ma. 16th, 60 ma. 18th, 85 ma. 23d, 60 ma. 25th, 75 ma. for 5 minutes each. Is now very well. On the right side the tumor is not within

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2½ inches of the ribs, and does not extend so far toward the back. On the left, there is a clear space between the ilium and the tumor, and the growth has become more lobulated.

July 10th.—To-day the lady called to say how well she was, and said that it was such a comfort to go about and not have the old tired feeling. She said that the tumor was becoming smaller.

CASE C.—Single, age 40; sister of the lady whose case is No. XCIX.; was sent by Dr. Wilson, of Gateshead.

For several years the patient has not felt well; she is always tired, and instead of being an active woman is slowly but steadily becoming an invalid. While she is not what might be called ill, yet she is unable to have much pleasure in living. There is not any menorrhagia. On examination, the tumor is found to be of moderate size, extending up to the umbilicus.

Though older than her sister, the tumor is either of later or of slower growth. Like her, she was not able to bear a strong dose of electricity; the average in the older lady being scarcely 80 ma., while in the younger it was slightly over 75. In both, the sound was always attached to the positive pole, and both are entirely pleased with the result of the treatment.

October 24th, 1888, 60 ma. 26th, 75 ma. 29th, 80 ma. 31st, 85 ma. for 5 minutes each.

November 2d, 85 ma. 7th, 85 ma. 16th, 75 ma. for 5 minutes each. An easy period, unaccompanied by headache. 19th, 65 ma. 21st, 75 ma. for 5 minutes each. Dr. Wilson was in town, and was much pleased with the progress that had been made. 23d, 80 ma. 26th, 85 ma. 30th, 80 ma. for 5 minutes each. The lady and her sister should have had an application on the 28th, but they could not come, as they had some friends staying with them, and had too much to do!

December 3d, 85 ma. 5th, 80 ma. 17th, 70 ma. for 5 minutes each. Again there has not been any disturbance at the period. 19th, 95 ma. 21st, 80 ma. 24th, 85 ma. 26th, 80 ma. 28th, 85 ma. for 5 minutes each.

January 18th, 1889, 75 ma. 23d, 70 ma. for 5 minutes each.

July 10th.—Says that she is very well.

CASE CI.—Married, age 30, was recommended by Dr. John Duncan, of Edinburgh, and was first seen in October, 1888.

A tumor was discovered after the birth of one of the chil-

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dren three years ago. In May a dead child was born, and since then there has been too much blood lost every month. The tumor is said to be growing rapidly. For ten years there has been dysmenorrhœa, and of late the pain has been getting much worse.

The tumor reaches to within 2 inches of the umbilicus, and extends far out on the right side, and has probably opened up the broad ligament.

October 18th, 1888.—100 ma. 20th, 100 ma. 22d, 75 ma. 24th, 100 ma. 26th, 120 ma. for 5 minutes each.

November 3d, 100 ma. for 5 minutes. There has been rather less flow, and accompanied by less pain, than for ten years. 5th, 120 ma. 7th, 140 ma. 9th, 145 ma. 12th, 145 ma. for 5 minutes each. The lady feels sleepy and disinclined for exertion in the afternoons of the days on which she has the treatment. 14th, 145 ma. 16th, 140 ma. 19th, 150 ma. 21st, 155 ma. 23d, 155 ma. for 5 minutes each.

December 4th, 135 ma. for 5 minutes. The period has been much the same as usual, except that there was less pain. The lady is to come up to town three times a week, a distance of one hour by train. 8th, 105 ma. 11th, 125 ma. 13th, 110 ma. 18th, 110 ma. 20th, 150 ma. 22d, 140 ma. for 5 minutes each.

January 1st, 1889, 120 ma. for 5 minutes. The period has not been such an easy one as the last. 3d, 130 ma. 5th, 135 ma. 8th, 100 ma. 10th, 130 ma. 12th, 120 ma. 15th, 120 ma. 17th, 125 ma. for 5 minutes each.

February 23d.—"I am just getting over my 'monthly,' and am sorry to say I have been quite as ill this time."

July 12th.—"I am glad to say I feel very well."

CASE CII.—Married, age 42; was sent by Dr. Graham, of Currie, N. B., in the beginning of the winter of 1888.

For the last few years this lady had not been feeling very well, and suffered much from dyspeptic symptoms. Treatment seemed to do little good, and the patient did not mention for a long time that she had considerable irritability of the bladder, necessitating her getting up at least four times during the night, and that there was also difficulty in defecation. As soon as those symptoms were spoken of, the tumor was discovered. For the last few months, there have been feverish attacks every month, during menstruation, due, the lady thought, to her getting cold when she had to get up during

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the night. Often, on going to bed feeling very tired, the patient felt certain that nothing would wake her, but for some years she has never got beyond one o'clock. She cannot sit comfortably, more especially when driving. There is not any menorrhagia.

The tumor fills the pelvis, and extends to 2 inches above the pubes. The sound enters easily about 5 inches.

November 1st, 1888, 65 ma. 3d, 85 ma. for 5 minutes each. Patient says that she feels better, and she had to empty the bladder once only last night. 6th, 85 ma. 8th, 75 ma. for 5 minutes each. Slept better last night than she had done for years, and instead of waking at one o'clock, slept on till five. 10th, 90 ma. 13th, 80 ma. for 5 minutes each. The lady says that she does not require to take any thought how she sits; she is perfectly comfortable. 20th, 75 ma. for 5 minutes. The period is over; there has been rather more flow than usual, but accompanied by much less pain. 22d, 85 ma. 24th, 90 ma. 27th, 90 ma. 29th, 100 ma. for 5 minutes each.

December 1st, 95 ma. 4th, 80 ma. 6th, 100 ma. 8th, 90 ma. 11th, 90 ma. for 5 minutes each. The period is due, and the patient states that she feels better than she has done for many years; usually at this time of the month, she has felt very uncomfortable. 15th, 100 ma. for 5 minutes. The period was got through without any discomfort or feverishness. 17th, 90 ma. 19th, 110 ma. 21st, 110 ma. 22d, 110 ma. 24th, 100 ma. 26th, 100 ma. 28th, 100 ma. 31st, 100 ma. for 5 minutes each.

January 2d, 1889.—100 ma. 4th, 100 ma. 5th, 100 ma. 7th, 100 ma. 10th, 115 ma. for 5 minutes each. There has been nothing to chronicle, as the patient has been quite well, and has been going to concerts and the theatres, as if there were nothing the matter with her.

June 7th, 1889.—"I am delighted to say I am enjoying very good health, and am equal to any amount of walking, driving, gardening, etc., without the aches and pains which resulted from such exercises last summer. We drive to town twice or three times a week; so 50 or 60 miles in a high dog-cart, that people 'without encumbrance' say wants the house steps to enable them to get up, is a strong testimonial in favor of the electricity that has lightened my load."

Case CIII.—Married, age 34; was brought by Dr. Ransford in November, 1888.

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The lady had not been well for ten years, since her younger child was born, but the history of the tumor appeared to date back about half that time. She suffers from very severe pain at the periods, so bad that lately she has required to have morphia injected usually 5 or 6 times. Hemorrhage also is a very prominent symptom, seventy diapers being used as a rule. She feels that something must be done, and that life is scarcely worth living.

On examination the tumor is found to be very prominent, and to extend to within an inch of the umbilicus. The sound passes to a depth of ten inches.

November 3d, 75 ma. 5th, 80 ma. 7th, 65 ma. 24th, 100 ma. for 5 minutes each. The period came on without any pain, but this appeared as the flow was leaving off. Feels very fairly well, however. 26th, 95 ma. 28th, 100 ma. 30th, 75 ma. for 5 minutes each.

December 3d, 50 ma. for 5 minutes. The period is on again accompanied by a great deal of pain. To stop this if possible the application was made to-day at the patient's own house, and the rest of the treatment will be conducted in the same manner. 5th, 70 ma. 7th, 80 ma. 10th, 80 ma. 12th, 100 ma. 14th, 70 ma. 17th, 70 ma. for 5 minutes each. The general condition improves and the tumor is smaller. 19th, 90 ma. 21st, 100 ma. 26th, 70 ma. for 5 minutes each. A small piece of tumor (?) came away yesterday. 28th, 65 ma. for 5 minutes.

January 1st, 1889, 120 ma. for 5 minutes. The loss has not been more than one-quarter of the usual, and morphia was required but three times. 3d, 130 ma. 5th, 130 ma. 7th, 130 ma. 9th, 100 ma. 11th, 150 ma. 14th, 100 ma. 16th, 110 ma. 18th, 115 ma. 23d, 120 ma. for 5 minutes each.

February 6th, 170 ma. 11th, 100 ma. for 5 minutes each. The last period was described as a splendid one, with less flow even than last time. The tumor is about one-third the size of what it was, and for the last few mornings the lady has been able to be down to breakfast by eight o'clock.

CASE CIV.—Single, age 33; was brought by Dr. Shaw Mackenzie.

Symptoms of something being wrong began four years ago, though for half of that time they were not very marked. For the last two years, however, she has found that she was

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beginning to lead the life of an invalid, and could walk a very short distance. Before she began to get ill the periods lasted for five days; now the flow lasts for eight, and the quantity of blood which is lost is more than double, and the interval of three weeks has been shortened to two. It is seldom that there is pain, but there is often sickness.

The lady looks white and listless, and the lips are very decidedly anæmic.

The tumor fills the pelvis, the cervix is low down, and the sound passes forward, leaving the bulk of the tumor behind.

It will be seen that this lady was never able to bear the passage of a strong current.

November 27th, and 29th, 1888, 50 ma. for 5 minutes.

December 4th, 65 ma. 6th, 70 ma. for 5 minutes each. The patient looks brighter, and says that she feels stronger and can walk better. 8th and 15th, 60 ma. for 5 minutes. The period has been much the same as usual. 17th, 60 ma. 20th, 70 ma. 22d, 70 ma. 27th, 70 ma. 29th, 65 ma. for 5 minutes each.

January 1st, 1889, 60 ma. 3d, 60 ma. 5th, 55 ma. for 5 minutes each. The period is commencing after an interval of three weeks. 10th, 55 ma. for 5 minutes. The quantity of blood has been greater, though the time has been shorter. Feels stronger than usual. 12th, 55 ma. 15th, 60 ma. 17th, 60 ma. 22d, 70 ma. 24th, 50 ma. 26th, 60 ma. 28th, 55 ma. for 5 minutes each.

February 7th, 60 ma. for 5 minutes. The period has been much the same as the last. 9th, 55 ma. 12th, 60 ma. 15th, 60 ma. 17th, 75 ma. 19th, 55 ma. 21st, 50 ma. for 5 minutes each. The tumor is smaller and does not lie so much toward the back. The patient says that she feels much stronger and can walk farther and with much more ease and comfort.

On 6th May the lady wrote, "You said that you would like to know how I got on, also I thought I should like to write and tell you how very much better I am feeling. My face is getting quite a color, and I think you would be satisfied with the progress I have made."

Case CV.—Single, age 29; was sent by Dr. Coleman, of Streatham, in December, 1888.

This young lady had been losing too much blood every month for four years. At first, and for two years, it did not

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affect her general health; but for the last two she has been becoming anæmic and breathless. Formerly, menstruation continued for five days; now it lasts for eight, and the loss is much in excess of what used to be natural to her. For a year she had been treated by a well-known gynecologist, with, at first, temporary benefit; but it had become evident that something stronger than medicine and general treatment would be required. After treatment by electricity had been advised, she was taken to see the most eminent specialist in London, who agreed that it was worth trying, at any rate.

The patient was very much blanched, and on examination it was found that the pelvis was entirely filled by a tumor, which projected up into the abdomen; the cervix was within an inch of the vaginal outlet. The sound passed forward for between 4 or 5 inches. For the first two weeks of the treatment the young lady lived in town; during the remainder of the time she went back and forward to her own home in Streatham.

December 11th, 1888, 80 ma. 13th, 100 ma. 15th, 100 ma. 17th, 115 ma. 19th, 100 ma. 21st, 115 ma. 24th, 100 ma. 28th, 105 ma. for 5 minutes each.

January 8th, 1889, 120 ma. for 5 minutes. The first period since the treatment was begun is over; it lasted six days, and the quantity of blood lost was greater than it had ever been. 10th, 130 ma. 12th, 120 ma. 15th, 120 ma. 17th, 125 ma. 22d, 125 ma. 24th, 150 ma. 26th, 160 ma. for 5 minutes each. The patient is beginning to feel a little better and stronger.

February 5th, 140 ma. for 5 minutes. The very worst period she has ever had is over. The flow continued for ten days. 7th, 160 ma. 9th, 150 ma. 12th, 130 ma. 19th, 80 ma. for 5 minutes each. The young lady is improving somewhat rapidly. 21st, 145 ma. 23d, 110 ma. 25th, 120 ma. for 5 minutes each. The color is much better; the tumor is beginning to rise up out of the pelvis.

March 7th, 150 ma. for 5 minutes. The period is just over; there has been less discharge than for the last eight months. The cervix is now far back in the pelvis, with the fundus uteri turned up into the abdomen. 14th, 75 ma. for 5 minutes. After going home on the 7th instant there was a sudden flow of blood, described as being most alarming; the bleeding continued for several days, and was accompanied by pain. 16th,

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110 ma. 19th, 115 ma. 21st, 110 ma. 23d, 120 ma. 26th, 120 ma. for 5 minutes each.

April 13th.—Another bad period has been passed through, during which there were several sudden gushes of blood.

May 9th.—"I am pleased to tell you my daughter is steadily improving. The last period was not excessive, and there was none of the sudden rushing at the end. Therefore she is much better than has been usual now it is over."

May 20th.—"I am glad to say my daughter continues to progress."

July 6th.—"It is two years since I had to tell Dr. Coleman how bad I was getting.

"The periods do not last more than three or four days. I am feeling so different from this time last year."

CASE CVI.—Single, age 48; was sent by Sir Spencer Wells in December, 1888.

This lady complained of symptoms due to the size of the tumor. For eighteen years she had known of the presence of a growth; but it has given rise to trouble only in the last year or two. She suffered from discomfort; from difficulty in walking and stooping; and also from a painful and full feeling high up in the left side. Arrangements had almost been made for the performance of hysterectomy, when the lady consulted Sir Spencer, who advised the electrical treatment, as there were no urgent symptoms calling for operative interference, especially at the age of 48. The broad ligaments were not opened up by the tumor, and operation would have been easy.

On examination, the tumor was found to be hard, large, and not movable. On the left side its upper margin was masked by the ribs, which were much elevated; on the right, the tumor barely reached up to the costal margin; but it caused very considerable bulging in the side. The sound passed to a depth of 7 inches.

December 19th, 70 ma. 21st, 70 ma. 24th, 90 ma. 26th, 110 ma. for 5 minutes each. The tumor is slightly movable, is smaller on the right side, and the lady thinks that she walks somewhat more easily. 28th and 31st, 100 ma. for 5 minutes. The period is almost due, and the patient is more comfortable than usual.

January 2d, 1889, 100 ma. 8th, 110 ma. for 5 minutes each. The period has been as usual; the patient walks better and is

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more comfortable. 10th, 130 ma. 14th, 125 ma. 16th, 110 ma. 18th, 130 ma. 29th, 100 ma. 31st, 110 ma. for 5 minutes each.

February 2d, 160 ma. 4th, 140 ma. for 5 minutes each. The tumor steadily decreases in size. 6th, 140 ma. 8th, 110 ma. 12th, 110 ma. 15th, 110 ma. 23d, 110 ma. 25th, 150 ma. for 5 minutes each. There is a marked difference in the size of the tumor, more especially on the right side. 27th, 135 ma. for 5 minutes.

March 1st, 125 ma. 4th, 120 ma. 6th, 140 ma. 14th, 145 ma. for 5 minutes each. The period came on a week too soon. The tumor does not bulge so much in the flanks, and the depth of the cavity is 5 inches. 16th, 145 ma. 18th, 125 ma. 20th, 120 ma. 22d, 120 ma. 25th, 120 ma. for 5 minutes each. The tumor is movable, and the abdominal wall is not so tightly stretched over it. The lady walks better and feels lighter. 27th, 120 ma. 29th, 115 ma. for 5 minutes each.

April 1st, 115 ma. 3d, 110 ma. for 5 minutes each. 9th, 120 ma. for 8 minutes. 11th, 115 ma. 13th, 125 ma. for 10 minutes each. For some time it has been possible to push the tips of the fingers between the ribs on the left side and what appeared to be the highest point of the tumor. To-day, on pressing deeply, a large mass was found to spring from the upper and back part of the tumor, and to extend deeply, up under the posterior half of the diaphragm. The tumor was thus larger than had been supposed, and the discomfort and feeling of fulness, originally complained of high up on the left side, were thus accounted for.

Called in July to say that she continued to improve and that her friends found her much better. The tumor was decidedly smaller than when last seen.

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ETHER-DRINKING;

ITS PREVALENCE AND RESULTS.

BY

ERNEST HART,

Editor of the "British Medical Journal;" Chairman of the Parliamentary Bills Committee of the British Medical Association, and Chairman of the National Health Society.

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ETHER-DRINKING;

ITS PREVALENCE AND RESULTS.

HISTORY — GEOGRAPHICAL DISTRIBUTION — DETAILS OF THE TRADE — METHODS OF DRINKING, DOSE, ETC. — EFFECTS, IMMEDIATE AND REMOTE — REMEDIES.

THE allegation of the use of ether as an intoxicant in Ireland is not a new one, but the references which have from time to time been made to the existence of such practice have been received with a good deal of indifference, if not incredulity. Moreover, the practice, so far as it has existed, was said to have largely died out. Lately, however, some very circumstantial statements which have appeared in the English and Irish press excited my interest so much that I determined to supplement some little personal knowledge which I had acquired of the facts on previous occasions by a detailed investigation conducted with a view to obtain all the available information as to the prevalence of the practice, its origin, localities, sources of supply, and the observed results. For this purpose, I applied for information directly to those in the best position to know all the facts accurately, that is to say, to the doctors and priests of the incriminated districts. Subsequently, I drew up a schedule of questions relating to the time at which ether-drinking came into fashion, as to the prevalence of the habit, as to the quantities taken, and its effects on the health, both of body and mind, and on the duration of life, which I placed in the hands of persons likely to have personal knowledge. Detailed replies to the questions have been received from twelve doctors, four Roman Catholic priests, and one clergyman of the Church of Ireland. I have also been able to obtain information from other sources of the places of supply and manufacture. To all these gentlemen

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I take this opportunity of expressing my thanks for their courtesy. The results of the inquiry are embodied in the present paper.

History.—There is some difference of testimony, or rather of opinion, as to the date of the origin of ether-drinking, and as to the causes which led to its introduction. The most generally-received belief is that it came into use after Father Mathew's preaching had banished whiskey from a considerable part of the north of Ireland. The "new drink" is supposed to have been introduced as a beverage which might be taken without "breaking the pledge"—in fact, as a liquor on which a man might get drunk with a clear conscience. Mr. H. N. Draper ("Medical Press and Circular," May 30th, 1877) says ether-drinking was first practised at Draperstown, County Derry, about 1842, while ether was sold for the first time at Maghera between 1845 and 1850, and the practice became very common there five or six years after its introduction, reaching its climax about 1869. Dr. B. W. Richardson says ether was introduced into Draperstown about 1846 or 1847, and for thirteen years at least it was sold freely. Dr. Walter Bernard, of Londonderry, whose personal experience extends over forty-two years, informs me that during all that time he has known ether-drinking to be practised; he considers its introduction to have been an indirect effect of the success of the teetotal movement. On the other hand, Dr. James L. Nevin, of Ballymoney, writes to me that "it is rather puzzling to get at the origin of its use, but I do not believe in the 'Father Mathew teetotal movement' cause. My own opinion is," he says, "that in a country whose people in the past have been notoriously addicted to illicit distilling, the impossibility of indulging in it now, owing to the present Inland Revenue watchfulness, has driven the people to ether as the best substitute for poteen."

In a further communication, Dr. Nevin adds: "Before the new excise arrangements and the increase of constabulary, that part of County Derry was notorious for illicit distillation." A medical practitioner, near Cookstown, to whom I am specially indebted for the fulness of his replies to my questions, but whose name I am not at liberty to disclose, says that he has known of the prevalence of the habit in that place for twenty years or more; "in fact," he writes, "the odor of ether on folks' breath is a very early recollection indeed. . . . The habit

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must have been in full swing in this district (including that of Moneymore and Draperstown) about 1870–72. How long it may have been in vogue before then I personally cannot say, but have been told it had been common many years before that period." He adds: "I have been told that some of the other medical men here and in the neighboring towns (Moneymore, Magherafelt, Draperstown, etc.) were strong believers in its efficacy as a medicine and stimulant, and that they even sold it in draughts over the counter on fair days, etc., to any one coming in to ask for it. Then I believe small country grocers and publicans bought quantities of it from these medical men, and at a later date from the pharmaceutical chemists and town publicans, and retailed it to the country people throughout the district."

Another of my correspondents attributes the origin of ether-drinking to its cheapness, adding that "the people living in the mountainous districts here are fond of white whiskey owing to its great warmth; and ether being the same color, they often get it perhaps when white whiskey would be out of stock." The Rev. Peter O'Kane, P.P. of Knockloughrin, County Derry, states that ether-drinking first came under his notice in 1865. He adds: "It was given by the doctors as medicine, and some of them sold it to the people in general. Then the public-houses sold it."

The Rev. Edward Gallen, C.C. of Granahan and Maghera, County Derry, who first heard of ether-drinking when appointed curate at Draperstown in 1871, gives me the following account of the origin of the practice: "About eight or ten years previous to 1871 a drug shop in Draperstown, belonging to a proprietor having little to do in the ordinary way, gave 'draughts' of ether as a stimulant cheaper than whiskey to healthy people. The evil soon spread." As we have seen, however, the habit was fully established many years before that time. Dr. F. Auterson, of Magherafelt, who has known of the existence of ether-drinking since 1853, gives the following account of its origin: "A few years prior to the above date an unqualified medical man named Kelly practised at Draperstown and kept a drug store. He drank more whiskey than was good for him; he was prevailed on to give up the whiskey, and then used the ether, and taught the people to use it also." This narrative seems to bear the stamp of intrinsic probability,

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and it may commend itself to historical critics as combining in itself the two theories above mentioned as to the origin of ether-drinking. As regards the history of the practice, therefore, it may be taken as proved that it began something less than half a century ago at Draperstown, in South Derry, that town being, in the words of one of my informants, the Rev. Edward Gallen, "the centre point and spring of ether-drinking." From Draperstown the habit spread over certain parts of the county of Londonderry, the borders of the neighboring counties of Antrim and Tyrone being also infected to a certain extent.

I cannot doubt, however, from the evidence before me that great impetus was given to the use of ether as a beverage by the Act 18 and 19 Vict., c. 37, passed in 1855–56, which had the object of allowing spirit of wine to be used duty free in the arts and manufactures, and for this purpose provided that such spirit should be rendered unfit for use as a beverage by the addition of not less than one-ninth of its bulk of wood naphtha—a mixture termed methylated spirit. I find in the "Pharmaceutical Journal" of that year that Mr. MacFarlane, of Edinburgh, states that both chloroform and ether could be produced from methylated spirit in a state of great purity. The chloroform was entirely free from any flavor derived from the naphtha, and the ether he thought was as good as much that is made in the usual way from spirit of wine. This was confirmed by Mr. Redwood. The "methylated ether," then, which we hear of as being sold as a beverage is altogether a different thing in point of flavor and odor from the nauseous methylated product known as methylated spirit. It is an ether prepared from methylated spirit, but in which nearly all the methyl products have been removed by purifying processes. I have here, however, the pure ether prepared from rectified spirit, and two grades of "methylated ether"—that is, ether prepared from methylated spirit. The difference is not very marked to the ordinary observer, except in price. The pure ether costs wholesale about 5s. a pound, the methylated ethers respectively 1s. 4d. and 8d. a pound; so that the price of one is about seven times the price of the other. It is to the introduction of this cheap ether, which can be retailed at a nominal price, and to the simultaneous activity in hunting down the illicit stills, that the prevalence of ether-drinking

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may, I believe, be traced; and I believe that Father Mathew's name and the alleged indirect influence of "taking the pledge" against alcohol have been drawn into the history with more picturesqueness than historical accuracy.

Geographical Distribution.—The point of greatest prevalence of ether-drinking is the southern part of the county of Londonderry; in the northern division of the county it appears to be practically unknown. Thus a well-known practitioner of Coleraine writes to me: "In an experience extending over the last seventeen years I have not met with a single case. . . . I only knew of ether-drinking during my apprenticeship, about 1866 or 1867. It was then mainly confined to that portion of South Derry about Draperstown and Maghera. Since then I understand the practice of drinking ether has extended to other districts around there, such as Bellaghy, Magherafelt, and the mountainous portion of the Moneymore district." Dr. H. S. Morrison, of Coleraine, also writes: "The habit is practically unknown in my district. Although some time ago a grocer in this neighborhood had it for sale, no one, so far as I can find out, except a very few patronized him. They were so few in number in this part of the country that keeping it did not pay, and it is now a thing of the past." Dr. Caldwell, of Coleraine, writes: "I never knew a single case of ether-drinking in this district, neither in my capacity as coroner, although my division is within three miles of Maghera." Dr. T. M. Bryson, J.P., of Limavady, another coroner, says: "Ether-drinking is not known, nor has it ever been practised in this part of County Derry." Dr. J. W. Watson, of Limavady, writes: "The practice has not extended to this portion of North Derry." All the testimony I have received goes, therefore, to show that the chief centres of ether-drinking are Draperstown, Maghera, Magherafelt, Tobermore, Desertmartin, and Moneymore in County Derry, and Cookstown in County Tyrone. The habit is also prevalent, though to a less extent, in a district of South Derry, included by a line drawn from Ballyronan through the villages of Castledawson, Knockloughrin, Gulladarf, and Clandy to Portglenone, and bounded on the other side by Lough Neagh, Lough Beg, and the Bann. With regard to Cookstown I may quote the words of Dr. M. J. Cordier Marmion, J.P., of Dungannon: "About three years ago I was practising in a small town named Pomeroy, about eight miles

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from Cookstown. The district for about five square miles is very mountainous and thickly populated with a poor class of farmers. There was scarcely a house in the various districts around but ether was largely indulged in." He adds. "I am at present practising at Dungannon, and although my practice extends over a large area, with very few exceptions I have not found ether indulged in." With reference to Dungannon, again, the Rev. P. J. Byrne writes: "As ether-drinking is quite unknown in this parish or district, I return your queries unsigned. I believe the practice does exist about ten miles distant from this." I may add that, from private information which I have obtained from a trustworthy source, a good deal of ether is sent from Belfast to Dungannon and Omagh; not much of it, however, seems to be consumed in these towns, which are rather local centres of distribution to other places.

Details of the Trade.—The fluid used is, as I have said, the ordinary methylated ether of commerce. I have taken some trouble to ascertain whence and in what quantities it is supplied to the ether-drinking districts, and although the dealers are not communicative and the difficulty of the inquiry was increased by the fact that an excise officer and an official of the Inland Revenue Board had in nearly all cases recently gone over the ground before me and thus put people on their guard, I have collected a mass of important information from which pretty accurate inferences can be drawn as to the amount of the intoxicant that is consumed in the north of Ireland. I have been assisted in the investigation by gentlemen whose names would be sufficient guarantees of their competence as witnesses in this matter, but I regret that I am not at liberty to mention them. It is obvious also that I cannot publicly mention the firms engaged in this traffic, but I have no objection to furnish information on this head privately to any authorities interested in the subject. It would certainly be desirable that the heads of these firms should be examined before the select committee. No ether appears to be manufactured in the north of Ireland, and one gentleman, with exceptional means of knowing, assures me that none is made in any part of Ireland. Mr. H. N. Draper, however, in one of the articles already referred to, asserts that one Dublin manufacturer sent 4,000 gallons yearly to Belfast, and the name of a firm who now make it in the same city has been supplied to

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me. The great bulk of the ether consumed in Ireland is, however, undoubtedly sent there from England. One firm in London supply about 150 Winchester quarts (half-gallon stoppered bottles) yearly to one druggist in Belfast. Another London firm send 50 "drums" (metal vessels, each containing about 10 gallons) a year to the north of Ireland; this is not nearly so much as they used to send fifteen years ago. The books of a very important firm near London, I am told, show extensive sales of methylated ether. The names of large Irish buyers are especially noticeable, and markedly influence the consumption. The amount sold was largest in 1876 and fell off more than one-third in a few years; latterly, however, it has again increased, so that in 1889 it was only about one-tenth less than in 1876. This firm, to its credit be it said, called the attention of the excise years ago to the consumption of methylated ether in Ireland, but little heed was taken of the communication. Another firm near London sends methylated ether to Belfast both in "drums" and in Winchester quarts, but their trade in the article has fallen off rather than increased of late years—"the excise looked after them too well," as the head of the firm said rather sorrowfully. Another London firm stated that their sales of methylated ether for drinking had diminished of late, though their actual sales had increased. There is also a firm at Newcastle, or rather Gateshead, which is known to send large quantities of ether to Ireland. A representative of a large Edinburgh firm stated that they do not make much methylated ether, and what they do supply is chiefly for anæsthetic purposes. They cannot compete with the price of the London makers. This gentleman added that very little ether is made in Edinburgh or Leith by other makers. These seven firms appear to comprise all the important manufacturers of ether in this country. The trade is chiefly in the hands of three of them, of which two are said to be "above reproach," though not, it would seem, *sans peur*, if one may judge from their dread of publicity in connection with this particular branch of their trade.

The result of these inquiries is to show that beyond all question a quantity of common methylated ether is sent from England, and particularly from London, or rather its eastern suburbs, very much larger than is consumed in England in proportion to the population. Of course, it cannot be con-

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cluded that all the large supply sent to Ireland is used as an intoxicant. There are many other legitimate medicinal and industrial purposes for which it may be employed. When purified, it is now largely used as an anæsthetic, and it is used therapeutically as a diffusible stimulant, a carminative, etc. In pharmacy it is used for collodion, for making salicylic corn solvents, etc. It is also used in ice-making, and for purposes of refrigeration in various ways, especially in the large breweries; and it is employed largely to abstract fats and oils from various substances, even from fish manure. For all these purposes I am assured the use of ether has very much increased in recent years. Again, it is used in photography. Still, when liberal allowance has been made for all these possible legitimate uses of methylated ether, the consumption of that substance in the north of Ireland, and particularly in the districts which have already been specially referred to, shows a large balance which can only be accounted for by its extensive use as an intoxicating drink.

A large part of the ether exported to Ireland is sent to Belfast, whence it is distributed to Draperstown, Maghera, Cookstown, Pomeroy, Omagh, and Dungannon. A most trustworthy informant assures me that the amount of ether supplied to all the rest of Ulster is a mere nothing compared with that supplied to these towns. One large dealer states that, roughly speaking, he distributes about 2 cwt. of methylated ether each month—that is, over 1 ton in the year. He says this amount is scattered through Ulster moderately evenly; he allows that a fairly large proportion goes to South Derry and Tyrone, but not in such quantities as to lead him to believe that it is used for drinking. He adds that, from his experience, the practice of ether-drinking is dying out. This gentleman, however, answered without reference to his books, and evidence from other quarters throws doubt upon his inferences. From another Belfast firm it was elicited that they sold to one retail dealer at Maghera from 10 to 15 gallons, and to one at Draperstown from 5 to 8 gallons, a month. Larger amounts are sent to Cookstown. Omagh was said by Mr. H. N. Draper in 1870 to take 450 Winchester quarts (equal to 225 gallons) yearly. Another Belfast dealer says he sells from 25 to 30 cwt. of methylated ether in the year, and the great bulk of it goes to the towns already mentioned in South Derry

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and Tyrone. From another wholesale dealer, who is not by any means the largest dealer in Belfast, specially interesting information was obtained. He buys 7,124 lbs. of methylated ether in the year; this is calculated on an average of six months as verified by his books. This amount is distributed over the whole of the northern half of Ireland, but not less than 5,074 lbs. go to the comparatively small ether-drinking district. The difference between these two amounts would represent the legitimate medicinal consumption, all the rest going to the few small towns so often mentioned. In Londonderry, as Dr. Walter Bernard informs me, the druggists used, fifteen or sixteen years ago, to supply large quantities of ether to the ether-drinking districts. This trade, however, they have now, according to him, given up. It should be added that, as regards population, the ether-drinking district compared with the area supplied contains a mere handful of inhabitants. All the evidence which I have collected tends to prove that the amount of ether sent to that district from Belfast is out of all proportion to that supplied to the remainder of the north of Ireland. An informant, who has special opportunities of knowing the facts, however, tells me that from what he has seen, the bulk of the ether consumed in South Derry and Tyrone comes direct from the English makers. One man at Cookstown habitually purchases fifty gallons and upward at a time direct from the makers. I have the names of several of the ether buyers in Cookstown, Draperstown, and Maghera, but for various reasons suppress them here. The ether brought from England is conveyed by three companies; that is, if the information given me is correct, only three companies will carry the "drums" which are known to contain ether. These are the Clyde Shipping Company (from London to Belfast direct); the Carron Carrying Company (from London to Belfast, via Leith); and the Antrim Ore Company, also via Leith. The Leith route perhaps accounts for the statement made by some of my informants who say that ether is sent to Ireland from Glasgow. The rate charged by the Clyde Shipping Company for ether to Belfast, including collection here, is 84s. 2d. a ton. Much of the ether which finds its way to Ireland, however, is smuggled, in order to avoid the extra carriage rate to which ether, as an explosive which must be carried on deck, would be subject. It is rebottled out of the

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"drums" into Winchester quarts and, under cover of this device, goes as "drugs."

The customers in the towns of the ether-drinking districts, who buy the drug in considerable quantities, either from the English makers or from the Belfast importers, are grocers, who are also in many cases in these sparsely-populated places druggists and general dealers. They retail the methylated ether over the counter, and in some instances supply it to still smaller dealers in the villages. This is proved by the fact that some of them, when getting their supply from Belfast, insist on an exact and uniform weight being put into each bottle, showing that they sell these bottles (each containing half a gallon) unopened. The price at which the three principal English manufacturers supply methylated ether is 8½d. per pound in quarts, or 8d. in "drums." Considering the light specific gravity of the liquid, this means very much less than ½d. an ounce. It will be seen from this that no other intoxicating drink can compare with methylated ether as regards cheapness. Its retail price is about 1d. per two drachms, or even ½d. for a drachm and a half. It is possible, therefore, to get rapidly intoxicated for a very few pence. The retail dealers, however, often dilute the ether which they receive from the makers to a considerable extent, and thus, according to the Rev. Dr. Carter, rector of Cookstown, clear a profit of cent per cent. Dr. Carter also says: "In small poor grocery shops ether is sold without restriction. It is hawked about by beggar-women and sold to the peasantry for eggs and farm produce." I am afraid I must add that it is occasionally sold over the counter by medical men, who keep "open surgeries." A practitioner at Limavady, where, as has been seen, ether-drinking is comparatively rare, informs me that his assistant is occasionally asked for a "draught of ether," and he has had to give instructions that the drug is not to be sold under any circumstances unless the purchaser is known and it is required for medicinal use. Another correspondent writes: "More than twenty years ago I served my apprenticeship in a 'medical hall' in a town in South Derry, and even then I frequently sold on market days what was called a 'dram' of ether, which consisted of 1½ drachms of good sulphuric ether, for which ½d. was charged." Another practitioner, writing from Cookstown, says: "The small retail country grocers seem to obtain un-

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limited supplies of it and to find a very ready sale for it here. I have also been told (this I will not personally vouch for) that both it and methylated spirit of wine can be obtained in the surgeries of some medical men in the district, the people coming in, ordering it, paying for it, and drinking it there, just as they would do whiskeys, beer, etc., in a public-house." This, however, is a painful subject, and I content myself with this passing allusion to it here, as it involves an imputation which I trust is very seldom deserved.

Method of Drinking, Dose, etc.—Mr. H. N. Draper (*loc. cit.*) says: "The usual quantity of ether taken at one time is from 2 to 4 drachms, and this dose is repeated twice, thrice, or even four and six times daily. It is taken unmixed with water; indeed, its very slight solubility in that fluid would make this a useless precaution; but the usual practice is to take first a mouthful of water, then the dose of ether, and again a mouthful of water." Dr. Richardson describes the process as slightly more elaborate. According to him, "the drinker first washes out his mouth with water 'to cool it;' next he swallows a little water to cool his throat; then he tosses down the glass of ether; finally, he closes in with another draught of water to keep the ether from rising, or, in other words, to cool the stomach." The ritual of ether-drinking is, however, not always the same. Dr. C. H. P. D. Graves, of Cookstown, informs me: "It is always the methylated spirit that is drunk, the usual quantity being about 2 drachms in water, but an experienced drinker can, by holding his nose, consume a large quantity undiluted." Another Cookstown doctor informs me that the ether "is commonly sold in 'draughts'—that is, quantities rather less than half a spirit-glassful. This is generally drunk neat at one gulp, and followed by a mouthful of water in the case of the novice, but the *habitué* scorns the water. This dose is repeated in varying frequency, according to the desire or habit of the individual. I have known about six or seven 'draughts' to be taken by one person in about an hour, but have often heard wonderful tales of some who consider about a pint not an extraordinary allowance for one individual during an ether debauch." With regard to the amount sufficient to produce intoxication, the same gentleman says: "The dose varies much according to constitution, age, and addiction to the habit. I have heard

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some boast that they could drink a dozen to twenty draughts in an evening, but a quarter of this amount would more than intoxicate an adult unused to the drug. In fact, one draught —less than half a wineglass—will produce ether intoxication in any one unaccustomed to it."

On the other hand, Dr. Hetherington, of the District Lunatic Asylum, Londonderry, says: "Two drachms is usually taken, which costs about 1d., and three or four of these intoxicate, but old hands can take much larger quantities." Dr. Nevin, of Ballymoney, says that as much as ten ounces may be habitually taken in the course of the day; he has heard of several ounces being taken at one dose. Dr. J. W. Watson, of Limavady, has heard men boast that they could drink a "noggin" (equal to five ounces) at a draught, but has never seen this feat actually performed. The largest quantity he has seen a man drink has been one ounce. These statements show that, as might *a priori* have been expected, the quantity of ether that can be drunk with impunity and the dose sufficient to produce intoxication vary, just as in the case of alcoholic stimulants and drugs of all kinds, according to individual idiosyncrasy, induced tolerance, physical condition, etc. The special danger of ether as compared with other intoxicants lies in the fact that, as the immediate effect passes off very quickly and leaves behind little or no discomfort in the shape of nausea, headache, dry mouth, etc., what Dr. Norman Kerr calls the "drama" of intoxication can be repeated several times in the day. As Dr. Graves, of Cookstown, says, "An ether drinker will get drunk half a dozen times a day." This, of course, is considered one of the chief advantages of ether by its victims and votaries.

Prevalence of the Evil.—Some idea of the magnitude of the consumption of methylated ether in South Derry and Tyrone may be gathered from the details that have been given as to the quantities supplied by certain large firms. There can be little doubt, however, that the actual trade is far larger than these figures would indicate. The whole business, however, is so shrouded in "decent obscurity" by most of those who have an interest in the traffic that it is at present impossible to obtain anything like trustworthy statistics on the subject. One can only judge of the extent to which the habit prevails from the statements made by competent observers,

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who speak from personal knowledge. Thus the Rev. Dr. Carter, rector of Cookstown, has publicly stated that "more than two tons of ether are openly passed along the railways each year into this district, while a larger quantity is conveyed secretly by rail or by private conveyances into the localities mentioned. . . . In two small villages I know of two traders who sell over 500 gallons each annually. . . . The habit grips whole families, and becomes hereditary and spreads with rapidity. Since I began my inquiries and called attention to the subject it has seized a new district." Again, the same authority says: "It is given by traders to school children and messengers, and in some towns and localities causes on Sundays the largest part of intoxication." In a letter to me, Dr. Carter says, with reference to these statements (which were made in the Dublin "Daily Express"): "On every item mentioned I have abundant proof from most reliable authorities." All my correspondents who are able to speak from personal experience have confirmed the statements made as to the prevalence of ether-drinking at Cookstown, Draperstown, Maghera, and the other towns so often mentioned. Dr. C. H. P. D. Graves, of Cookstown, writes: "Being medical dispensary officer of the Cookstown District, I am brought into close contact with all classes. I find ether-drinking more prevalent among the very poor than among the well-to-do, I suppose on account of cheapness; but even if a person who is comfortably off begins drinking ether, he is sure to reduce himself to poverty, the habit being as pernicious as opium-eating. . . . On Saturday evenings (market day) the atmosphere along the roads is simply impregnated with the fumes of ether, so many of the market people drink it." Another informant, speaking of South Derry, says that the doctor to whom he was apprenticed some twenty years ago told him that "the practice of drinking ether in the district prevailed to such an extent that there were scattered over the country what was known as ether-houses, where a cheap and impure article was sold." My correspondent goes on to say: "From information received from a reliable source, I believe the practice of drinking ether has grown considerably since then." Another correspondent, speaking of the districts surrounding Cookstown, Moneymore, and Draperstown, says: "Its odor is often to be felt in people's breath, and even the very atmosphere is loaded

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with it in some places, and especially about fair times. Its odor seems to cling to the very hedges and houses for some time." Dr. Cordier Marmion, J.P., writing from Dungannon, says: "The coroner for this division of the county held an inquest some few months ago in or about Pomeroy, where a person's death was caused by an overdose of ether. He commented strongly in his address to the jury on the frightful absue of ether-drinking in this part of the North." A practitioner at Cookstown writes: "I have noticed its odor in the breath of hundreds of people. I know and have known perhaps well on to a hundred people who take it pretty freely. . . . You would be surprised to know how many comparatively respectable people take it, and do not seem at all ashamed to do so. Of course, these generally say they take it for 'wind in the stomach,' 'pain in the head,' 'giddiness,' etc., using it as a domestic medicine, and often keeping a considerable supply in their homes. It is often drunk to intoxication at wakes and dances, especially in the more backward and mountainous districts." Dr. Hetherington, of the Londonderry District Lunatic Asylum, writes: "Its use was kept in check for some time, but is now largely on the increase. . . . It is drunk by both sexes, young and old; not so much, however, as yet among young girls. . . . It appears to take a great hold on the people." One of the guards of the Derry Central Railway from Coleraine through the ether-drinking districts informed Dr. Walter Bernard that the smell of ether in the third-class carriages on market days from the women coming from Maghera is "disgusting and abominable," and the odor is even worse on the last Tuesday of each month, the fair day at Maghera. Dr. Bernard also tells me that, for the last two years, ether-drinking has been greatly on the increase in the southern portion of the county of Londonderry "among all denominations belonging especially to the small farming and laboring classes."

On the other hand, the few priests who have favored me with replies show a tendency (perhaps not altogether unnatural) to minimize the extent of the evil. Father B. Nugent, of Cookstown, says: "Ether-drinking in this parish is a reserved sin for Catholics for the past seven years. It is not sold by them, nor used to my knowledge except by the advice of a physician in case of sickness." Father Edward Gallen, C.C. of

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Granahan and Maghera, writes: "Ether-drinking has almost died out in my particular neighborhood. About fifteen years ago a man fell dead on the street of Draperstown from ether. The Catholic clergy immediately after denounced both the selling of it in the little shops and the drinking of it. It died away to a considerable extent for many years. It revived much a few years ago. Our attention reverted to the suppression of it anew. In this parish I publicly from the altar banned it a year ago. Both sellers and drinkers obeyed my proclamation. There is no drinking of it here now. I believe the same is true of other parishes near me." But how are we to reconcile this opinion with the circumstantial evidence to the contrary from other quarters? It is a remarkable coincidence that a similar statement about Maghera (which seems always to have enjoyed a "bad eminence" in respect of ether-drinking) is quoted by Mr. Draper, writing in 1877. He says ("Med. Press and Circular," May 30th, 1877): "In the same town [Maghera] and in the adjoining parishes the use of ether is dying out, owing to the fact that it has been, as the people say, 'cursed' by the parish priest, and it is said that now 'no Catholic dare sell it.'" Probably this was the time of the first conversion alluded to by Father Gallen, and from these repeated relapses it may be gathered how firmly the habit has taken root in that district.

It is a curious fact, if it be true as alleged, that ether-drinking flourishes chiefly among Roman Catholics, the Protestant communities being comparatively free from that particular vice. Dr. Morrison, of Coleraine, says: "I think it very questionable if, with the exception of an isolated case, Protestants are at all addicted to the habit." With regard to Ireland especially, one has always to be on one's guard against being misled by statements colored or distorted by *odium theologicum*, but the assertion here referred to comes to me from so many quarters that it is almost impossible to suppose that there is not at least some sort of foundation for it. In contrast, however, with this statement that there is no ether-drinking among Protestants are the information and reports which led the General Synod of the Church of Ireland some time ago to forward a petition to Parliament praying for the regulation of the ether traffic. The synods of the dioceses of Armagh and Derry also adopted similar resolutions on the

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urgent representations of clergymen and magistrates of the counties referred to.

Effects, Immediate and Remote.—The immediate effects of drinking ether are similar to those produced by alcohol, but everything takes place more rapidly; the stages of excitement, mental confusion, loss of muscular control, and loss of consciousness follow each other so quickly that they cannot be clearly separated from each other. It is only the "immoderate" ether drinkers who drink themselves into stupor; many are content not to go beyond the stage of exhilaration, when they become very talkative and laugh hysterically. The effect wears off almost as speedily as it comes on. What De Quincey said of the terrible attractions of alcohol is still more true of ether. The endeavor to renew the state of exaltation induced by the first dose drives the drinker to take more and more of the stimulant, till it becomes a tyrannical abuse, leading to effects precisely opposite to those first arrived at.

That ether is frequently drunk to the extent of inducing intoxication all my witnesses are agreed. Thus the Cookstown authority whom I have so freely quoted says: "It is often drunk to intoxication at wakes and dances, especially in the more backward and mountainous districts. Its effects are very rapidly produced and the stage of excitement very marked. Those under its influence will shout, dance, laugh, and act like maniacs, and, if the dose has been heavy, may fall down writhing and foaming at the mouth. They recover generally soon, and feel low, weak, and depressed, and often then will renew the dose, for which they have generally a strong craving. A smaller dose produces exhilaration and a peculiar feeling of lightness, the person imagining he or she could jump up and fly."

The same close observer thus describes the symptoms often produced by ether-drinking: "Profuse salivation often follows the drinking of ether, and then usually rather violent eructations; the face becomes flushed, and may become livid if large quantities are taken; afterward pallor, weakness, and burning pain at the epigastrium are generally present. Frenzy, maniacal excitement, and ultimately stupor supervene when the dose is large and taken within a short space of time."

Dr. J. W. Watson writes: "It is usually drunk for the pur-

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pose of producing intoxication, people drinking it and 'treating' each other as they do with whiskey in other parts of Ireland, or beer in England. The intoxication comes on quickly and passes off quickly. All ether drinkers agree that it is a pleasurable form of intoxication, and others can see that it is a very violent form of intoxication. However, the most violent condition is produced when whiskey and ether are both taken." Dr. Watson and others say that ether drinkers are very quarrelsome in their cups, the intoxication being decidedly of the "fighting" type.

With regard to the more remote effects of ether there is not much to be said. Very little appears to be known by pathologists of any injurious effect it may have on the tissues. Dr. Richardson himself is fain to confess with some regret that there is not much to be said against ether-drinking from this point of view. There are no gross lesions like the shrinking and induration of brain and liver characteristic of alcohol; ether is a thief that steals away the brains without leaving any visible mark of his presence. I have made special inquiries as to its effect on the health, and so far as "moderate" drinkers are concerned, there does not seem to be any evidence that the habit produces anything worse than chronic gastritis and dyspepsia. With regard to the worst cases, however, a careful observer writes: "In ether drinkers who have long followed the habit I have seen general debility, great nervous prostration accompanied by tremors (muscles of neck and forearm mainly affected), indigestion, irregular action of heart, subacute gastritis, a peculiar white-sallow complexion, and in some cases (personally observed) a peculiar livid cyanotic face."

Dr. Walter Bernard notes the following among the injurious effects on health which ether-drinking gives rise to: "Absence of subcutaneous fat, muscular wasting, feeble circulation, pale lemon and brown colored skin, reflexes exaggerated, especially knee-jerks." One terrible effect of ether-drinking is the profound degeneration of the moral character which it often induces; the victims fall into a kind of chronic hysterical condition, lose all self-respect, and, as in the case of nearly all who abuse narcotics, will lie and even steal to procure their favorite stimulant.

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Touching the tendency of ether-drinking to produce insanity, my informants are divided in opinion. Dr. Hetherington, of the Londonderry District Asylum, writes: "I cannot connect cases of insanity directly with its use, though many of my patients have been addicted to the habit. The districts named have always had a large proportion of insane irrespective of ether-drinking." Dr. Walter Bernard, visiting and consulting physician to the same asylum, thinks that ether, while not *per se* a cause of insanity, calls into action any dormant tendency to insanity that may exist. My Cookstown authority has himself attended cases in which he considered "the insanity certainly to some extent dependent, both as an exciting and a predisposing cause, on the ether habit." Other correspondents deny that there is any connection, other than accidental, between ether-drinking and madness. The habit seems to lead to crime only through the violence and pugnacity which have already been alluded to as characteristic features of the first stage of ether intoxication.

With regard to the effect of ether-drinking on the duration of life, very little positive evidence is forthcoming. Dr. Walter Bernard says it tends to shorten life by interfering with nutrition and damaging the glandular system. Apart from this, it is obvious that the ether drinker is a "bad life" from the insurance point of view, as he is exposed to many risks from which other people are free. He may at any time kill himself with an overdose of his favorite drug. There have, I believe, been several sudden deaths in the ether-drinking districts which have been attributed to this cause, and inquests have been held on them. I have tried to obtain details of one or two such cases, but have not been successful. The sudden deaths alluded to by more than one of my clerical correspondents, and utilized by them in the pulpit, were probably due to heart disease. One peculiar danger to which it is alleged that ether drinkers are exposed is that of setting themselves on fire in lighting a pipe, etc. Several cases of this kind, all bearing a somewhat suspicious family likeness to each other, are related by my correspondents, but the fact seems well authenticated, at least in some instances.

I have tried to put the results of my inquiry fairly and dispassionately before you. I have let my witnesses as far as

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possible speak for themselves, and the paper I have had the honor of reading before you is founded entirely on the evidence with which they have supplied me. It is the testimony of men living in daily contact with the things they describe, and it points to the existence of a very serious evil among a people otherwise exceptionally well conducted. If the physical effects of the habit seem comparatively unimportant, it must be remembered that the subject has never, so far as I know, been really investigated by pathologists armed with all the resources of modern science. Moreover, it must not be forgotten that the majority of ether drinkers are robust country people, living under very healthy conditions. The effects of the habit will no doubt be better seen in their descendants, if the evil is allowed to continue. At present, as has been shown, it is confined within relatively narrow limits, but what guarantee is there against its spreading over the length and breadth of Ireland and clouding the spirit and sapping the physique of the "finest peasantry in the world?" Nay, what security is there against the importation of the vice into this country and the hastening thereby of that decay which, as those uncomfortable persons—the political philosophers—are always telling us, must speedily overtake us? Already, as I am told on the authority of one of the largest manufacturers of ether in this country, ether-drinking is practised in Lincolnshire, and I have not the least doubt that the practice must be frequent enough in London. Many isolated instances have been casually reported to me, and possibly more may now come to light. I know personally of two cases, in one of which it led to a fatal termination.

The sale of ether as an intoxicant must be "stamped out" by the law, but how is this to be done? I am not here to answer that question; I can only say that some obvious remedies lie near at hand. The difficulty is to restrict the sale of ether as an intoxicant without interfering with its legitimate use as a surgical anæsthetic or for various manufacturing purposes. It has been suggested that the sale of it should be confined to qualified pharmaceutical chemists, or that retailers should be required to take out a license. As most of those who indulge in ether-drinking buy it in "draughts" at a time, I would suggest that the sale of it in smaller quantities than,

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say, a gallon should be made an offence punishable by a graduated system of fines, the amount increasing with the frequency of conviction. This would strike at the root of the traffic in ether as a cheap intoxicant, and would go far to put an end to the evil. It is earnestly to be hoped that the legislature may at last be roused into taking some action in the matter, and that a remedy may be found for an evil of the existence of which few people are aware.

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THE MODERN DIAGNOSIS OF DISEASES OF THE STOMACH.
By J. M. PURSER, M.D., Dublin.

UNSOUNDNESS OF MIND, IN ITS LEGAL AND MEDICAL CONSIDERATIONS. By J. W. HUME WILLIAMS, London.

BALDNESS AND GRAYNESS; THEIR ETIOLOGY, PATHOLOGY, AND TREATMENT. By TOM ROBINSON, M.D., London.

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THE MODERN DIAGNOSIS

OF

DISEASES OF THE STOMACH.

BY

J. M. PURSER, M.D.,

DUBLIN.

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THE MODERN DIAGNOSIS OF

DISEASES OF THE STOMACH.

WHILE in former times physiologists assigned to the stomach very exaggerated powers, both mechanical and chemical, and while it was looked on as the principal organ of digestion, at present the tendency is rather to minimize its functions and to assign to it a place in the act of digestion inferior and subordinate to that attributed to the pancreas. Until the proteolytic action of the pancreatic secretion was proved by Corvisart, Bernard, Kühne, and others, we knew no place where proteids were digested except in the stomach; but now the universally-recognized power of the pancreas to digest albuminous substances seems to make the stomach a superfluous organ, or to reduce its functions merely to those of a receptacle in which the food is retained for a time and passed on into the intestine gradually, so as not to over-distend the narrow tube of the duodenum, or to too greatly overtax the power of the pancreas.

There is not wanting experimental evidence that life and health may be maintained in the complete absence of stomach digestion. The entire stomach, or all but a very small portion, has been removed from a dog, and the animal has recovered and lived in good health. Czerny has succeeded in keeping a dog for five and a half years after this formidable operation, and at the time when he was killed he was lively, voracious, able to eat and digest as well as other dogs, and the assimilation of his food and character of his fæces were in all respects normal.

In the human subject cases have been observed of persons whose gastric contents were constantly found free from both

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hydrochloric acid and pepsin, in whom, nevertheless, digestion was fairly performed and the health was very good.

Very numerous experiments have been made on dogs into whose pylorus a fistula was established. The food was passed through this fistula into the duodenum, while the opening of the stomach was closed by an obturator. It was easy to keep these animals alive and in good health and nutrition, although the food was unacted on by the stomach, and digestion was exclusively intestinal. It was found that raw flesh was digested far more rapidly in the intestine than in the stomach. In one experiment there disappeared from the stomach in two hours 53 per cent, from the intestine 85.7 per cent, of the introduced nitrogen. Boiled eggs, rubbed up with salt solution, and boiled connective tissue, as skin, were well digested by the pancreas; while boiled flesh, raw connective tissue, and (curiously) finely-divided casein were not digested in the intestine, but caused diarrhœa and were soon expelled.[1]

It would appear, then, from these observations, as if the digestive function of the stomach was not indispensable; and, in view of this, another function has recently been assigned to the organ which is, it is maintained, far more important than that of digesting proteids. The prominence given by recent researches to the action of micro-organisms is very great, and we are familiar with the idea that the greater part of the struggle for existence consists in a continuous warfare with these bodies. We know that every article of food or drink we take swarms with them, and the question naturally arose, How are the worst forms of putrefaction prevented in our intestines? How do we exist for a day without infection from the various pathogenic organisms which must perpetually find their way down our œsophagus?

We know that micrococci and bacteria thrive badly or are killed in an acid medium, and it has been supposed that the stomach, by virtue of its acid secretion, serves as a guard at the upper end of the alimentary canal to arrest or kill off the swallowed germs, which, if allowed passage into the intestine, would there induce abnormal putrefactions or give rise to other abnormal conditions. This view has been brought forward in a most attractive way by Brieger,[2] who points out that the acidity of the gastric juice, as determined by Schmidt, Heidenhain, and Hoppe Seyler, is just of that degree which

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has been found by the experiments of Sieber, Nencki, and Miquel to be effective in promoting the putrefaction of animal infusions.

That such a germicidal function is performed by the stomach there can be little doubt. Alapy[3] found that the organisms which cause traumatic infection, as streptococcus pyogenes, erysipelas coccus, and staphylococcus pyogenes aureus, were killed in their passage through the stomach of healthy rabbits, and could not be found in the intestine; while if the acidity of the gastric juice was diminished or neutralized, they passed without difficulty, and were found living in the entire intestinal tract.

MacFadyen,[4] however, found that the gastric juice did not exert such a destructive action on bacteria as is often stated. He experimented with nine kinds of organisms. All of these resisted four hours' action of HCl of 0.05 per cent. All except two—Koch's comma bacillus and the spirillum of Finkler and Prior—survived HCl of 0.1 per cent. Two only—staphylococcus aureus and the typhoid bacillus—withstood acid of 0.3 per cent, while all were killed by stronger acid.

Pepsin alone had no action, and, mixed with the acid, did not influence the results.

Spores are very resisting, and can easily resist the action of the gastric juice. Anthrax spores are killed by 2 per cent HCl only on the tenth day.

In experiments made on dogs who were fed with pure cultures of bacteria added to their food, it was found that the organisms could be got from the intestinal contents. Even such delicate organisms as B. anthracis and Koch's comma bacillus could, when given in water to fasting animals, pass through the stomach and be found living and capable of culture in the small intestine. The question is somewhat complicated by the fact that in the intestine the germs grow in an oxygen-free medium. This will explain why the number of germs which can be detected by the microscope is greater than those which can be cultivated from the intestinal contents. MacFadyen found that when he made his cultures anaërobically in an atmosphere of hydrogen the number of colonies was far greater than that got by ordinary methods.

Hueppe[5] has recently shown that when facultative anaërobic germs, as cholera bacillus, are grown in an atmosphere

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free of oxygen their virulence is greatly increased—*i.e.*, they produce their toxin more energetically and rapidly than under ordinary circumstances, but their susceptibility to the action of external agencies is also increased, so that, in this condition, they are almost infallibly destroyed by the action of the gastric juice. When, however, they are grown for a time in an oxygenated atmosphere, they become more resistant, and may pass uninjured through the stomach and excite their specific fermentation in the intestine. By this discovery is explained why perfectly recent cholera dejections are less virulent than those which have been exposed for some time outside the body. Further, it explains the influence of external circumstances, as the condition of the subsoil water in the spread of the disease, and shows that in estimating the chances which a germ has of passing through the stomach safely we must consider not only the acidity of the gastric juice and the kind of organism, but also the condition of the latter at the time of its entrance into the system. Hueppe proposes as a remedy for cholera salol, a substance which passes through the stomach unchanged, but in the alkaline intestine is split into salicylic acid, which acts directly on the now susceptible anaërobic germs.

This very important question—how far the acidity of the stomach protects us from the entrance of living germs into the lower part of the intestine—has been studied indirectly. It is known that some of the products of intestinal putrefaction are absorbed from the bowel, and are excreted in the urine, in the case of the aromatic substances, as indol, skatol, phenol, conjugated with sulphuric acid in ethereal combinations. The quantity of these substances in the urine may be taken as a measure of intestinal putrefaction, and we all know the large quantities of indigo and phenol which may be got from the urine in cases of intestinal obstruction, peritonitis, and other conditions, where, owing to retention of matter in the bowel, the putrefactions advanced beyond their due limits. Wasbutzki[6] found in patients suffering from stomach diseases of different kinds that where in the stomach HCl is deficient and intense bacterial fermentation occurs, the proportion of conjugated sulphuric acid in the urine is increased; that in cases of intense yeasty fermentation where HCl is abundant the conjugated sulphuric acid is diminished. In two cases, although

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HCl was absent, the conjugated sulphuric acid was diminished. Here, however, there was an abundant formation of organic acids, lactic and butyric, in the stomach, and these had the same antifermentative action as that usually exerted by the HCl. Indeed, MacFadyen has found that these acids have a marked effect in destroying bacteria.

Kost [7] experimented on men, and found that where with a constant diet alkalies were administered so as to make the urine alkaline, the conjugated sulphuric acid in the urine was constantly increased, which is attributable to the freer entrance of putrefactive germs into the intestine through the neutral or alkaline stomach.

Unfortunately as yet we are not acquainted with any substance in the urine from which we can conclude that pathogenic bacteria are present in the intestine. In a remarkable case of cystinuria, v. Udránzsky [8] and Baumann found in the urine, besides the cystin, constantly for more than a year, penta- and tetra-methylendiamins, which were shown to be identical with the ptomaïnes discovered by Brieger, and named by him cadaverine and putrescine. Since Brieger has shown that these bodies are found in certain putrefactions and in the cultures of certain bacteria, as cholera bacillus and Finkler and Prior's vibrio, attention was directed to the fæces in which also these ptomaïnes were found. Hitherto diamins have been found only in the urine of cases of cystinuria, and do not occur in the stools of healthy patients. Indeed, so far they have been found only in cystinuria and in the semen-smelling discharges of cholera patients. They are probably the products of the metabolism of special bacteria which exist in the intestine of cystin patients. Kost, alluding to this case, anticipates that we shall find in the urine in other abnormal states substances which will enable us to recognize the existence of various pathogenic bacteria in the intestine, and the occurrence of fermentation produced by them.

But while we must admit that the stomach, by its acidity, does serve an important purpose in guarding from bacteria the lower parts of the digestive tract, I believe there are few who will be ready to allow that this is its main function, or who will not hold this as secondary to the digestive action which it exerts in certain classes of foods.

That the secretions of the stomach are capable of dissolv-

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ing many alimentary substances has been known since the experiments of Reamur and Stevens, who found that substances inclosed in perforated tubes soon disappeared when the tubes were introduced into the stomach either of animals or of men. That this was a purely chemical solution which could be effected outside the body was shown by Spallanzani, who first made experiments on artificial digestion with the gastric juice expressed from sponges which had been swallowed and again drawn up by attached strings from the stomach.

The entire subject of the chemical processes which are due to the action of the gastric juice has undergone an immense development of late years, and we now know that these are due to the agency of a substance—pepsin—belonging to the class of ferments or enzymes. This pepsin, however, will not act except in the presence of a free acid, and the secretion of the stomach in health is always acid. On the nature of this acid much uncertainty prevailed for a long time, but the fundamental observation of C. Schmidt set the question at rest. He found that, supposing all the bases present to be combined with chlorine, there was still a large excess of HCl, and that this excess required for its neutralization just that quantity of alkali necessary to neutralize the gastric juice itself. Thus he proved not only that free HCl was present, but that it was the only acid present. No doubt HCl is, except in most exceptional cases, the only acid secreted, but we shall see that in every act of digestion other acids are present whose appearance, disappearance, and relative proportion to the HCl are objects of great importance in the investigation of the digestive act as performed in the human stomach.

Although we speak of the stomach as a single glandular organ, and the gastric juice as a single secretion, yet really it is not so. The structure of the stomach differs in different parts, and so do the secretions. The pyloric part has long been known to differ from the rest, but until 1878 much uncertainty prevailed as to the exact nature of the secretion formed by each part. Heidenhain then isolated successfully the pyloric portion, leaving its blood-vessels and nerves intact. He joined the fundus to the duodenum, and made a sac of the isolated pylorus, attaching its edges to the wound in the abdomen, so that its secretion flowed out and could be collected. This operation had been performed before by Klemensiewicz, but his

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dog lived only a few days. Heidenhain succeeded in keeping one dog alive for 12 days, when he had to be killed in consequence of stricture of the passage into the intestine. Another dog lived in good health for 10 weeks. The secretion from the pyloric region was alkaline, clear, viscid from the presence of much mucus, and contained pepsin in abundance, as shown by its powerful digestive action when made acid by HCl. It also contained the second gastric ferment—namely, rennet—for when added to fresh milk, without any addition of acid, it quickly caused curdling.

Heidenhain next performed the still more difficult operation of isolating a large piece of the fundus of the stomach, and converting it into a sac opening outward. Of dogs so treated one lived 14 days, another a month. The secretion of the fundus was a clear, colorless, limpid fluid containing very little mucus. It contained solids in smaller, but acid in larger, proportion than had been found in the entire gastric juice (0.45 per cent against 2.694 per cent; ash, 0.13–0.35 per cent against 0.676 per cent; free HCl, 0.52 per cent against 0.305 per cent), and organic matter, chiefly pepsin. Thus pepsin is secreted by all parts of the dog's stomach, but acid only in the fundus. In some animals the stomach is much more complex. I do not speak of the multilocular ruminant stomach; but even in those in whom there is but one cavity we often find a region devoid of glands and lined by a scaly epithelium, and Ellenberger[9] and Hofmeister have recently described six separate regions in the stomach of the pig.

The chemical changes effected by the gastric juice in the different food stuffs have been studied mainly by the method of artificial digestion. There is no difficulty in getting an extract of the mucous membrane of the stomach which shall contain pepsin in greater or less purity, and which, when made suitably acid by HCl, shall dissolve and change, or, as it is said, digest proteid substances. It is only on these proteids that artificial gastric juice will act.

The proteid of a solid is observed, firstly, to swell and then to dissolve. If the action is prolonged, under favorable conditions, the final result is a substance called peptone. This differs in many important respects from the original proteid. It does not precipitate with heat or HNO_3, or with K_4FeCy_6, or NaCl in acid solution. It is not precipitated by neutraliza-

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tion, or by many metallic salts. It is not precipitated by $(NH_4)_2SO_4$, but if a peptone solution be saturated with this salt and boiled at 110° C. a resinous mass separates. Peptone is completely precipitated by tannin, $KI+HgI_2$, and nearly so by phosphotungstic acid, phosphomolybdic acid, and picric acid. It is also precipitated, but incompletely, by alcohol. The peptone got by acid peptic digestion is known as amphopeptone, and is uninfluenced by further gastric digestion, but when submitted to pancreatic digestion half of it disappears and is transformed into leucin, tyrosin, and other bodies, while the other half remains, giving much the same reactions as before. This unaltered peptone is called antipeptone. Gastric or amphopeptone is thus supposed to be a mixture of antipeptone, which resists further change by the pancreas, and hemipeptone, which by the pancreas is further broken up. It is probable that peptone has never yet been got perfectly pure. Kühne and Chittenden[10] have prepared ampho- and anti-peptone by an elaborate method, but the differences in the elementary composition found in the different analyses suggest that these bodies are mixed with other unknown substances. As found, they were, when dried, very hygroscopic powders, hissing and giving off vapor when moistened, like phosphoric anhydride. They had a disgusting, bitter taste, and rotated the plane of polarization to the left. While amphopeptone gave Millon's reaction, antipeptone did not.[11] As this reaction is known to depend on the presence of the phenol group of aromatic substances, which includes tyrosin, aromatic oxyacids, phenol, cresol, we must conclude that between the two peptones, which resemble each other in so many respects, this great difference obtains—that the aromatic phenol group is absent in anti- but present in hemi-peptone. Corresponding to this, where antipeptone was decomposed by boiling with H_2SO_4, little or no tyrosin could be got.

While solutions of albumin filter and dialyze with great slowness and difficulty, peptone solutions filter freely and dialyse with comparative rapidity. This would point to a diminution in the size of the molecule. Whether this is due to a polymerization or to a hydrolytic splitting of the proteid molecule is a matter of uncertainty. The results of elementary analysis do not settle the question. Whatever the change consists in, it is evidently one which can easily be gone back

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on. We know that during digestion in the living body peptone is formed in considerable quantity, while no peptone can be found in the blood; hence, during the act of absorption a reconversion of peptone into albumin must be effected. Outside the body Henniger, by action of acetic anhydride, and Hofmeister, by action of an elevated temperature on peptone, have converted this into a body giving proteid reactions, while, more recently, Michailov [12] has found that concentrated alkaline peptone solutions, by merely standing at body temperature, are changed partly into globulins, partly into albumins.

But between the original proteid and the ultimate amphopeptone are many intermediate stages, and there is much probability that the matters are absorbed when they have reached these stages without going any further. These intermediate products are, therefore, of interest, not only chemically but physiologically, and they have been made the subject of extensive researches in recent years.

As first product is a substance which is completely precipitated by neutralization. This is closely related to, if not absolutely identical with, acid albumin, which is got, although more slowly, by action of acid alone, without aid of pepsin. Between this and peptone are a group of bodies known as albumoses, for our knowledge of which we are largely indebted to Kühne and his school.

These bodies can be got as follows: If all the coagulable albumin is separated by heat and the acid albumin by neutralization, there remain only the albumoses and peptones. Ammonium sulphate does not precipitate the latter, while by it the albumoses are completely precipitated in a soluble form. It would occupy too much time to enter at any length into the history of these bodies, of which there are several kinds. I must confine myself to only a few statements. From the artificial digestion of fibrin Kühne and Chittenden [13] have got four albumoses: 1. Proto-albumose, precipitable by saturation with NaCl, and soluble in cold and hot water. 2. Hetero-albumose, precipitable by NaCl to saturation, soluble in dilute saline solution, but insoluble in water, hot or cold. 3. Dys-albumose, precipitable by saturated NaCl, but insoluble in dilute saline solution and in water. 4. Deutero-albumose, not precipitated by NaCl, but by NaCl+acetic acid. These reactions admit of a ready separation of these bodies.

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Albumoses of similar kind have been got from myosin[14] (myosinoses); from globulin (globuloses);[15] from egg albumin;[16] from casein (caseoses);[17] from elastin[18] (elastoses).

Albumoses are bodies very commonly found in both the animal and vegetable kingdoms. They are of interest because, among other reasons, they have often extremely poisonous properties. It has long been known that so-called peptone injected into the blood-vessels of dogs and cats causes extreme depression and lowering of blood-pressure, with tendency to hemorrhage, and often death, and that the blood loses temporarily its power of coagulation. Kühne and Chittenden found that the pure peptones had not this effect; and Pollitzer[19] found that antipeptone was usually without effect, while, in decreasing degree, hetero-albumose, proto-albumose, and amphopeptone caused narcosis, fall of blood-pressure, and loss of coagulability of the blood in dogs. From the recent researches of Brieger and Fraenkel[20] in the poisonous products of the metabolism of the diphtheria bacillus and other pathogenic micro-organisms, it appears that these are of an albuminous nature, probably closely allied to albumoses; while the investigations of Weir Mitchell and Reichert[21] and those of Wolfenden[22] show that in snake venom the poisonous principle is not an alkaloid, but an albuminous substance of a globulin and peptone-like nature, which will possibly turn out to be an albumose. Martin and Wolfenden[23] have found that the jequirity poison is not, as was at one time supposed, of a bacterial nature, but is due to a globulin and an albumose, both of which have been isolated and their action studied.

Before proceeding to the recent additions to our knowledge of the chemical processes which take place in the human stomach, and the means by which they have been arrived at, a short account may be given of some of the more interesting facts which have been ascertained in the case of animals.

Schmidt-Mülheim[24] found in dogs fed on meat that digestion is mainly effected in the stomach; that the greater part of the proteid is converted into peptone; so that at all stages of digestion the peptone is to the simply dissolved albumin as 2 is to 3 about. Further, not only is the proportion of these bodies to one another constant, but the absolute quantities of each in the stomach is constant, showing that as fast as the proteid is digested or dissolved it is either absorbed or passed

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on into the intestine. The remarkable dryness of the contents of the stomach is noteworthy, so that in the first six hours it was not coherent, but fell to pieces in a crumbling state.

In contrast to the carnivorous dog we may take the herbivorous horse. In this animal the stomach is remarkably small, having a capacity of only 15–18 litres. "When a horse eats five kilos of hay, representing one-half its daily ration, requiring two hours for its consumption, and impregnates it with twenty litres of saliva, the mass would occupy a space of 28–30 cubic decimetres (litres). As the stomach is functionally most active when only two-thirds distended—that is, while containing about ten litres—the stomach must, therefore, fill and empty itself two or three times during one meal."[25] Stomach digestion is thus reduced to a very short process, and digestion is largely effected in the capacious and complicated intestine. Nevertheless, Goldschmidt[26] has shown that even in the horse the stomach is, considering its size, much more active than the intestine. In the former 55 per cent proteids and 40 per cent non-nitrogenous matters are digested, while in the intestine only 75 per cent proteids and 65 per cent non-nitrogenous matters are digested. Ellenberger and Hofmeister[27] find in the horse that in the first stage of stomach digestion lactic acid only is present, and during this period the transformation of starch into sugar under the influence of the swallowed saliva (and possibly of an amylolytic ferment furnished by the stomach itself) may still go on. Later HCl appears and increases until, when it has reached 0.03–0.04 per cent, the digestion of starch is no longer possible. This is generally true for herbivoræ and omnivoræ, including, as we shall subsequently see, man; but in carnivoræ, although at early stages HCl is present only in very small quantity, and not to be detected by ordinary tests, yet there is no lactic-acid stage.[28] Ellenberger and Hofmeister,[29] too, find in pigs fed on pure meat diet that there is little organic acid in the stomach contents, while on starchy diet these acids are abundant.

Goldschmidt,[30] however, finds that the process is more complicated than this simple division into two stages would indicate. There is, first, a pure amylolytic stage lasting about an hour, in which, in all parts of the stomach, starch is converted into sugar and lactic acid. Secondly, an amyloproteolytic stage, in which amylolysis occurs chiefly, and in all parts,

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but also proteolysis everywhere, but specially in the fundus part of the proper secreting stomach; this stage lasts up to about the seventh hour. Thirdly, there is a stage of partial, or local, digestion, in which, in the middle region of the stomach—that is, those parts where the proper fundus glands exist—proteolysis only occurs, while elsewhere starch is digested. This stage usually lasts until the next meal, but is sometimes followed by a fourth stage, in which, from abundance of HCl in all parts of the stomach, amylolysis is no longer possible, and proteolysis only occurs. These stages pass gradually into one another, and their distinctness is not always evident. The contents of the stomach are very dry, and fresh food pushes before it what was already in the stomach without becoming mixed with it. The kind of digestion which any particular particle of food undergoes depends very much on the course it takes between the œsophagus and the pylorus. From the former the food diverges in a fan-like manner. Those parts which in their passage are most exposed to the action of the fundus, where only HCl is secreted, undergo most proteolytic changes; elsewhere amylolysis preponderates.

Among omnivoræ important observations have been made in the digestion of the pig.[81] In this animal the stomach consists, as said, of several regions differing from one another in structure. Near the entrance of the œsophagus is one devoid of glands and secreting nothing. The diverticulum from the left extremity and a region corresponding to the left half of the great curvature yield an alkaline secretion containing no pepsin, but a diastatic ferment. The remainder of the great curvature has true fundus glands, and secretes HCl and pepsin and rennet, while the lesser curvature and pylorus yield a neutral secretion containing no acid, very little pepsin, and much mucus. In this animal also the contents of the stomach are very dry, and mixture takes place to only a very limited extent. Digestion runs in stages, at first one in which lactic acid only is present, and in which everywhere amylolysis, without proteolysis, takes place. Gradually the fundus portion secretes HCl and pepsin; and here proteolysis only occurs, while in the cardiac portion amylolysis still takes place, and in the pyloric portion both starch and proteid are undergoing digestion. Finally, a stage of almost pure proteolysis—but even to the last some amylolysis takes place at the cardiac

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end. With a diet of potatoes the results are quite analogous to those described above, which were obtained on a diet of oats. As stated above, in pigs the lactic-acid stage is slight or absent on a purely flesh diet.

These differences in the powers of stomach digestion in the different species of animals make it impossible to conclude from physiological experiment as to the details of the process as carried on in the human body. Hence it was of the greatest importance that observations should be made on men, and having got an accurate knowledge of the normal course of digestion, that a study should be made of the variations which occur in the chemistry of digestion in the abnormal conditions of the human stomach. Until recently our information on this point was mainly derived from the cases of gastric fistula, more particularly from that of the famous Alexis St. Martin, on whom Dr. Beaumont's classical observations were made. It is unnecessary to refer further to these observations, since they are in their main features familiar to every one. But of late years a method has come more and more into use which has thrown a flood of light on the normal and abnormal chemistry of the stomach, which is of daily practice abroad, but which is as yet far too little employed among us. The main object of this paper is to bring this method prominently under notice and to recount the most important results which have been arrived at by its means.

Considering how readily accessible the stomach is, it is strange that it is only recently the process of digestion has been studied by removal of the contents of the organ at varying periods after eating and examination of the matters thus withdrawn. By this means the characters of the secretion and the effects produced by its action on the different kinds of food stuffs can be determined with greater certainty than in any other way, and a completely objective and scientific knowledge can be obtained of the disturbed function of the organ, contrasting with the obscurity and uncertainty of the information derivable from symptoms for the most part of doubtful import.

It has been objected that the passage of a tube into the stomach is a disgusting procedure, and would not be submitted to by patients. The disgustingness of a medical or surgical method of treatment is entirely a matter of conventionality.

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To my mind the passage of an œsophageal tube is less disgusting than the administration of an enema, and infinitely less disgusting than a rectal or vaginal examination. When patients get used to hearing of it they will not think of it as strange or disgusting, and in cases where it is practised the relief obtained is so great that patients are seldom unwilling to submit themselves to a repetition of the operation as often as is necessary.

The procedure is very simple. A soft India-rubber tube is passed without difficulty into the stomach.[32] If the patient then makes a forcing movement with the abdominal muscles, the contents of the stomach are expressed through the tube, and can be collected for examination. If it is desirable to wash out the contents of the stomach completely a longer tube is used, water is poured in from a height by a funnel until a sufficient quantity has been introduced, then the funnel is lowered and the contents run off by a siphon action, which if it does not start of itself can be readily set going by a contraction of the abdominal muscles. I am aware that the practice of washing out the stomach in cases of gastric enlargement with fermentation of the contents is largely employed here, although by no means so largely as it deserves; but the method of diagnosticating stomach diseases by a study of its contents removed for this purpose is, I believe, not at all employed. It is this proceeding which I would now advocate, as having already introduced a new era into the history of gastric pathology and therapeutics and as promising still greater results in the future.

I shall first briefly indicate the principal results which have been got by a study of normal digestion, and then notice what has been found in abnormal conditions.

The question would be greatly complicated if it was attempted to study the digestion of one of our usual complex meals, composed as it is of all kinds of the most heterogeneous matters.

It is necessary to take a simpler object for examination. The first systematic observations of this kind were made by Ewald and Boas,[33] who had at their disposal female patients whose digestion was good and nutrition perfect, but who had the habit of vomiting at variable times after meals, either voluntarily or when they drank some water. With the

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vomited matters or the contents of the stomach removed by expression the observations were made. The patients received meals composed either of white bread and water, of scraped meat, of egg albumin, potatoes, or of these substances combined. The main results arrived at were these:

During fasting the stomach is found free from remains of food. Water introduced and withdrawn is neutral, and contained neither HCl, nor lactic acid, nor peptone.

Very shortly after a meal of 60 grams of white bread (even within 10 minutes) fermentation lactic acid is present, and increases up to 30–40 minutes, then HCl appears. Further on HCl increases, while, *pari passu*, lactic acid diminishes, and after about an hour HCl only is present. The same is true with potatoes.

With scraped meat lactic acid is found also at early stages, but now it is not fermentation or æthylidene lactic acid, but æthylene or paralactic acid. This acid occurs up to 50 minutes after food. From 60–90 minutes it is found together with HCl, while this acid only is found after 100–120 minutes. The course is similar, but more rapid, with fish diet. In all these cases the lactic acid is not secreted by the stomach, but derived from the food—the æthylidene lactic acid by the fermentation of the carbohydrates, while the sarcolactic acid is extracted from the meat. That this is so is shown by the absence of lactic acid at all stages of digestion of egg albumen, which contains no lactic acid and cannot furnish it by fermentation. When bread, meat, and albumen were given together, the same three stages were observed. That HCl promotes the disappearance of free lactic acid from the stomach is probable from the above observations, and was proved by experiments specially directed to this point. This is due apparently to the more ready decomposition of alkaline chlorides by lactic acid when some free HCl is present, and also possibly to a more rapid removal of lactic acid from the stomach, while its further formation by fermentation is prevented by the presence of HCl. That lactic acid, however, is not necessary for the formation of HCl is shown by the presence of the latter in digestion of egg albumin, when lactic acid is absent at all stages. Since peptone is present even in the first stage of digestion, some pepsin must then be secreted. The quantity is, however, very small, and it is only coincidently with the appearance of

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HCl that the pepsin becomes abundant. Everything which slows digestion delays the appearance of HCl and prolongs the lactic-acid stage. This was found to be the case during menstruation, in subacute and chronic gastric catarrh, and markedly so when fat was added to the food. Hence we have in the undue prolongation of the first stage of digestion an objective measure of the degree of dyspeptic conditions.

It is obviously necessary, in order that the digestive power of different stomachs may be compared, that the substances submitted to digestion should be always similar in quantity and quality, and further, in order to facilitate the examination, it is advantageous that the food given should, while containing representations of the different food stuffs, be of as simple composition as possible. Of these test-meals two have been chiefly employed—the Probefrühstück, recommended by Ewald and Boas; and the Probemittagbrod, used by Leube and Riegel. The former consists of 35 grams of white bread and one-third litre of water or weak tea without milk or sugar. The examination is made one hour after eating. The Mittagbrod is more like an ordinary meal, consisting of 300–400 grams of soup, 125 grams of beefsteak, with 50 grams of white bread, and sometimes potatoes. This meal requiring much longer digestion, the contents of the stomach are not drawn off until 3–4 hours after eating.

Some discussion has arisen as to the respective merits of these test-meals. The question has been examined by Einhorn,[34] who administered both to the same persons on the same day, and compared the results. He experimented both on persons with disordered digestions and those whose stomachs were healthy. He concludes strongly in favor of the simpler Frühstück. He finds that the quantity of acid salts introduced with the meat greatly complicates the determination of the HCl; that, while an hour after the Frühstück lactic acid is usually absent and HCl present, 3 to 4 hours after the Mittagbrod lactic acid is usually present and free HCl is variable, and often absent, being all combined with albuminates or otherwise. In the long time which elapses between eating and the examination in the Mittagbrod, the fluid part of the food is often absorbed to such a degree as to make the removal of the contents of the stomach difficult and to render it impossible to obtain enough fluid for the application of the necessary

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tests. Besides, as pointed out by Ewald,[85] the matters withdrawn after the Frühstück are much less offensive than those after the Mittagbrod. The bread contains all the food stuffs —proteids, fat, carbohydrates, salts, and extractives. It is, of course, not a very severe test of the powers of the stomach, but it has been found to work well and a great part of our knowledge has been got by its means.

The course of the normal digestion of such a meal shows the following stages in acidity: Within 10 minutes the filtered contents of the stomach are acid, either from free acid, acid salts, or both. Free acid, if present, is lactic acid. It is probable that from the first HCl is present, but its presence is concealed in consequence of its being combined, or because of the presence of salts, which interfere with the delicacy of the tests. Up to 30–40 minutes lactic acid only is discoverable by the chemical tests. After this first stage is a second, in which HCl appears and can be found in increasing quantity, together with lactic acid. With the small meal HCl increases to a maximum of 1.5–2.0 per thousand, but with a more abundant meal it may rise to 2–3.3 per thousand. After about an hour HCl alone is found. Some lactic acid may still be present, but unless in pathological amount is not discoverable by tests.

In an examination of the contents of the stomach got by vomiting or removal by the tube we have to consider—firstly, the acids; secondly, the ferments; and, thirdly, the changes effected in the food during its stay in the stomach.

The gastric contents are usually acid both in health and disease. The presence of an acid reaction should be due to free acid, but is often due largely or altogether to acid salts. We have, therefore, to determine first whether free acid is present, and then to investigate the nature of the acid. The normal acid of the gastric juice is HCl, but, as we have seen, it is usual at certain stages of digestion to find lactic acid either alone or in company with HCl. It is by no means rare to find other organic acids, chiefly acetic and butyric acid, which owe their origin to abnormal fermentation.

A really accurate scientific examination of the acids is accompanied by some difficulty, and can be carried out only by one versed in chemical manipulation and with the resources of a chemical laboratory. The principle consists in separating the volatile acids by distillation, removing the lactic acid

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from the residue by repeated extraction with ether, and finally titrating what is left for HCl. In order not to overestimate this by counting in the acid salts, it has been proposed[36] to precipitate the free HCl by freshly-prepared cinchonin, to extract with chloroform the compound of HCl and cinchonin, and then titrate the former by silver.

To separate the HCl from the organic acids, and to estimate it quantitatively, Sjöqvist[37] adds $BaCO_3$, evaporates to dryness, and carbonizes the dry mass. By this means the baryta salts of the organic acids are changed to carbonates. The mass is then extracted with water. This leaves the insoluble $BaCO_3$, but extracts the $BaCl_2$ from the original HCl. In this the Cl can be determined by titration with potassium bichromate.

V. Jaksch[38] modifies and simplifies this process by estimating not the Cl, but Ba, in the $BaCl_2$ gravimetrically as barium sulphate.

All these methods require time and chemical skill which are not possessed by the average medical man, and consequently, if a chemical analysis of the contents of the stomach is to be used for clinical purposes, some simpler methods of examination must be found. Several of these have been introduced of late years—which, although they cannot pretend to scientific accuracy, are, nevertheless, of sufficient delicacy, and, if carefully employed, are sufficiently free from fallacy to justify their use; and it cannot be denied that by their aid our knowledge of the physiology and pathology of stomach digestion has been considerably advanced.

These are mostly color tests. It would take too much time to describe them all, and this is the more unnecessary as a very full description of them is given in the recently translated work of v. Jaksch on medical diagnosis.[39] I shall merely mention those which I have found most useful, and whose employment will usually suffice in practice.

In order to determine whether the acid reaction is due to free acid or acid salts, tropæolin (00) or Congo-red may be employed. The former becomes brown, the latter blue, if free acid be present, while these reactions are not produced by acid salts.

In order to show whether the free acid is HCl or lactic acid, we use methyl or gentian violet, which is turned blue

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by HCl, but is not changed by lactic acid except this acid is present in larger quantity than is usually the case. Still more delicate is the phloroglucin-vanillin test of Günzburg.[40] This test will show HCl in dilution of 0.05 per thousand (1 in 20,000), while methyl-violet fails below 0.24 per thousand (1 in 4,000).[41]

In order to show the presence of lactic acid, Uffelmann's iron carbolic acid test gives good results. The fallacies arising from the sugar and phosphates may be avoided by testing, not the original filtrate of the stomach contents, but the residue of the ether extract of this. This will detect 0.1 per thousand lactic acid.

Butyric and acetic acid are best detected by their smell.

The total acidity of the stomach contents is determined by titration with dilute ($\frac{1}{10}$ normal soda solution). Each c.c. of this solution is equivalent to 0.003646 HCl. On hour after the Probefrühstück 10 c.c. gastric contents should require from 4–6.5 c.c. of the alkaline solution, which equals 0.146–0.237 per cent. Values above or below these limits are pathological (Ewald).

For pepsin we have no test except its power of digesting proteid. Some of the fluid to be examined is placed in a test-tube, and small pieces of boiled fibrin or, still better, slices of boiled egg albumen are added, and the whole is placed in the water bath regulated at 100° F. If the fluid is neutral or very feebly acid some dilute HCl should be added. It is well to act on these portions: 1. The original filtrate. 2. The same, with addition of an equal quantity of dilute HCl. 3. The same as 2, but boiled for a few seconds. In this last no solution of proteid should occur. The quantity of the fluid should be the same in the three tests, and to each the same quantity of proteid should be added.

The other ferment or the rennet can be detected only by its power of coagulating milk in neutral solution. Some interesting and valuable observations have been made recently on the occurrence of this ferment. Schumburg[42] examined the stomachs of human corpses, and got variable results, sometimes positive, sometimes negative. Among the former was a six-months' fœtus. In the stomach of a calf immediately after death abundant rennet was found, while in the contents of a dog's stomach, vomited after apomorphin, only feeble re-

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sults were obtained. The contents of the living human stomach were got by swallowing sponges. Out of ten experiments made in this way only one yielded positive results. Boas[43] has studied the contents of the human stomach withdrawn during life, in both healthy and diseased persons. He finds that sufficient care has not been taken to distinguish between the perfectly-formed rennet ferment and its zymogen. Whenever free HCl is present, either during digestion or in case of hypersecretion during fasting, there rennet is found. The zymogen is present also during the entire period of digestion and can be shown by its greater resistance to alkalies. Thus the contents of the stomach are made alkaline with Na_2CO_3. This destroys the ferment, but not the zymogen. If the fluid be then made acid and finally neutralized, or if $CaCl_2$ or other lime salts be added, the zymogen is converted into the ferment and milk is coagulated. The zymogen is also much more resistant to elevation of temperature than the ferment, which is destroyed at 70° C. When acid is absent ferment is also absent, but the zymogen is present. The same is true of pepsin and its zymogen. Thus an important function of the acid of the gastric juice is to convert the zymogens which are secreted by the glands into the active ferments.

Klemperer,[44] too, arrives at very similar conclusions. The ferment he finds present only when acid is present. The zymogen is always to be found. Hence the examination for rennet has no diagnostic importance, since its presence or absence is only an additional proof of the presence or absence of acid, while the absence of zymogen would point to serious impairment in the functions of the stomach glands.

These researches[45] give new ideas as to the use of adding lime-water or other lime salts to milk in cases of difficult digestion. The commonly-received view is that the lime prevents or modifies the coagulation. But it would appear that its use is to favor coagulation, and so to prevent the undigested milk from passing too rapidly into the intestines.

I shall now notice some of the more important diseases in which the chemistry of stomach digestion has been investigated, and in which this investigation has increased our knowledge.

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I. Cancer.

Of these one of the most important is cancer of the stomach. It is unnecessary to remark on the great difficulties which frequently attend the recognition of this affection, and it must be evident that now more than ever an early diagnosis is desirable, since if surgical interference is ever to succeed, it must be when it is undertaken at the commencement of the disease.

It is now many years since Van der Velden announced that in cancer of the stomach free hydrochloric acid is absent in the contents of this organ. A similar observation was made, however, many years previously by Dr. Golding Bird, and has been rescued from oblivion by Ewald.[46] The importance of the subject is shown by the large number of works which have been devoted to it in recent times. Among the most important of these are the reports of Professor Riegel, of Giessen, on the cases of stomach diseases treated in his klinik during the years 1885 and 1886. These cases were observed in the most careful manner. The stomach contents were repeatedly examined for HCl and inorganic acids, and in all cases their power of digesting albumin was tested. In the first report[47] 15 cases of cancer of the stomach are tabulated. In 13 there was dilatation of the stomach. In 2 this could not be detected. In 5 cases the diagnosis was confirmed by autopsy. In the others the diagnosis was made by the usual symptoms—as tumor, ectasia, hæmatemesis, cachexia, etc.; 231 observations were made. In none of the fatal cases was HCl ever found. In 3 of the others it was present at first, but disappeared in the later stages. Riegel thinks that the constant, or almost constant, absence of free HCl, supposing that the examination is rightly made, speaks strongly for the diagnosis of cancer; the presence of free HCl, supposing the examinations are sufficiently often repeated, speaks equally or more strongly against cancer. Although for seven years he has examined every case, he has never met a case of carcinoma in which free HCl was constantly found, and in which normal digestive power existed. He quotes cases in which, in absence of other symptoms, and in young persons, the diagnosis of cancer was made solely on the constant absence of HCl, and cases in which the general symptoms pointed strongly to cancer, and yet from

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the presence of HCl the contrary diagnosis was made, and in both instances the result showed the justice of the opinion arrived at.

In the second report [48] we have a record of 306 observations of the gastric contents of 16 cases of cancer. Five cases were fatal. In no single one of these was free HCl found, and in not one of 154 artificial digestion experiments was albumin digested. Of the remaining 11 cases, 8 never had any free HCl, and manifested no digestive power, while the remaining 3 at first showed traces of free acid and of peptic power, but subsequently lost both.

Jaworski and Gluzinski [49] also found no free HCl in the examination of their cases of carcinoma of the stomach.

These observations were made by the color tests. By the more accurately scientific, but by no means unobjectionable, methods of Cahn and v. Mering, HCl is found in cases of cancer. The acid residue, however, left after removal of the volatile acids and of the lactic acid does not give the color tests, and, above all, does not digest albumin. Hence the HCl is not free, but combined—probably largely—with proteid substance or peptone. If to the gastric juice of a cancerous patient HCl be added, it to a great extent disappears as free acid, while the volatile acids and lactic acids increase.[50] This points to the deficiency of HCl for the complete saturation of the ingesta.

Rare cases of cancer, however, occur in which free HCl is present. Cahn reports one,[51] and in the discussion on his paper others were mentioned. Ewald [52] details a case where, until shortly before death, free HCl was present, although it disappeared before the operation was performed, in consequence of which the patient died. In some of these cases the cancer seems to have been secondary to an ulcer, in which condition, as we shall subsequently see, the free acid is usually increased.

The question then arises, What is the connection between cancer and the disappearance of HCl from the gastric juice? On this subject two views are held. According to the one, supported by Ewald, Stiénon, Rosenheim, etc., the chemical insufficiency is due to an inflammatory or atrophic condition of the entire mucous membrane. According to Ewald,[53] the condition is one of catarrhal inflammation; Stiénon [54] has found in 4 out of 8 cases atrophy of the glands; and Rosenheim [55]

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found in 14 out of 16 cases of cancer inflammatory degeneration of the mucous membrane, commencing as catarrhal inflammation, advancing to interstitial change and atrophy.

On the other hand, Riegel doubts the general validity of this explanation, and thinks that the absence of the acid is due not so much to its non-secretion as to its being combined by some substance arising from the cancer. This view is supported by a case in which the stomach was free from disease, but the cancer was situated at the commencement of the duodenum, and nevertheless there was an absence of free acid and of peptic potency. Rosenbach,[56] who thinks very little of the value of an examination for free acid in the diagnosis of carcinoma, holds that the occasional absence of acid occurs in those cases in which the cancer is ulcerated and furnishes from its discharging surface albuminous matters which combine with and conceal the acid.

More important than those cases of cancer in which HCl is present are those cases in which the acid is absent and yet the disease is not carcinoma. That such cases occur is admitted by every one, but they are seldom of a kind which can be confounded with cancer. Among the more important conditions in which this occurs may be mentioned four—extensive amyloid disease of the stomach; severe mucous catarrh, leading to atrophy, neurasthenia, great anæmia; certain cases of nervous dyspepsia; advanced cases of renal disease and cancer of the œsophagus.

Riegel[57] has, however, in cases of cancer of the œsophagus, found the secretion normal, while he records cases of permanent regurgitation of bile into the stomach, and a case of true gastritis[58] from drinking sulphuric acid in which HCl was permanently absent.

In cancer the organic acids are usually abundant in the contents of the stomach, and, except in very rare cases, pepsin is present, although sometimes in diminished quantity. The anatomical changes found in the mucous membrane are least marked near the pylorus, and from the glands of this part the pepsin may be furnished, even while the oxyntic glands of the fundus may be out of action. As is known, pepsin is usually to be found in the urine, and its source is believed to be the stomach, from which it is absorbed. In some cases of cancer of the stomach pepsin has been absent from the

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urine;[59] hence we may assume that it has not been formed by the peptic glands.

As regards the presence of rennet, in three cases of cancer of the stomach Boas found no rennet in the contents withdrawn from the stomach. In two of these, however, milk was coagulated when swallowed. He regards[60] the absence of rennet as not typical for carcinoma, but merely as an expression of the general degeneration of the mucous membrane which occurs in this disease, and to which he attributes also the absence of HCl.

On a review of the entire subject, while it must be admitted that rare cases of cancer occur in which free HCl is present, and that still more frequently HCl is absent in cases which are not cancer, so that this sign is no more than others absolutely pathognomonic, yet it is one of great importance, and in all suspicious cases frequent chemical examination of the contents of the stomach should never be omitted.

II. Chronic Ulcer.

In great contrast to cancer stands another very common disease of the stomach—namely, chronic ulcer. Of this condition Riegel gives in his first report 8 cases, with 21 observations; in his second, 42 cases, with 382 analyses. In all of these acid was present, and in most cases in considerably larger quantity than in health—0.4–0.5 per cent against 0.15–0.2 per cent. Van der Velden[61] also has found hyperacidity—0.26, 0.47, and 0.42 per cent in three cases respectively. The digestive power of such gastric juice is greater than normal. Organic acids are absent or present in small quantity.

Other observers have, however, not found the hyperacidity of the gastric juice so constant a symptom in cases of ulcer. Gerhardt[62] got in 7 out of 24 cases negative results by testing for acids with color tests, and Rosenheim, who examined 8 undoubted cases by the method of Cahn and v. Mering, found in 2 hyperacidity, 4 times normal amount of acid, and twice diminished acid. Ewald, too, adduces evidence against the universality of the rule of Riegel, but admits that the want of hyperacidity is the exception. On the part of the most experienced physicians a fear is entertained of the use of the tube in gastric ulcer. Some cases are recorded of hemorrhage, and even perforation, following its employment.[63]

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Hyperacidity, so frequently associated with gastric ulcer, to the occurrence of which it is a strong predisponent, is apt to pass into hypersecretion, a condition in which, even during fasting, an acid fluid, having all the characters of gastric juice, is secreted in such quantity that 300 to 500 c.c. may be drawn off. The fasting secretion may be of the degree of acidity of normal gastric juice, while that secreted during digestion is abnormally acid.[64] Such a state of hypersecretion may occur as an acute and transitory affection principally in nervous persons. Its occurrence as a chronic condition, although mentioned by several older writers, chiefly English, has only recently attracted very much attention. Riegel,[65] in his second report, records 686 analyses of the gastric contents of 18 such cases. In these the digestion of albuminous food is rapid and complete, while the digestion of starchy food does not take place owing to the high acidity. This retention of matters in the stomach leads usually to dilatation.

In these cases matters lodge in the stomach owing to deficient absorption and impairment of the motor power of the stomach, and these retained matters keep up the irritation on which the abnormal secretion depends.[66]

It must not be supposed, however, that in all cases of acidity, whether with or without hypersecretion, the absorption is defective and movements sluggish. On the contrary, the absorption as tested by iodide of potassium has been found in such cases abnormally rapid, and Van der Velden[67] has found in healthy persons that this drug appeared more rapidly in the saliva if acid were swallowed than if merely water were drunk. In many cases of hypersecretion and acidity increased peristalsis occurs; that, nevertheless, matters tend to lodge abnormally long in the stomach is due to a simultaneous non-activity of the pylorus leading to spasmodic closure.[68]

The diagnosis of hypersecretion is to be made with certainty only by an examination of the contents of the stomach, removed during fasting after previous washing out of all remains of food. In many cases, in the morning after the stomach had been washed out the evening before, and no food taken in the interval, considerable quantities of gastric juice are found. In other cases, as in those of Van der Velden, the stomach is empty after the night. The symptoms are ambiguous. The patients have usually complained of stomach

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distress for a long time. They suffer from pain, often of a spasmodic kind, relieved by eating, particularly albuminous food; heartburn, shown by Reichmann[69] to be due to the entrance of acid matters into the œsophagus; eructations of odorless gas, and sometimes vomiting of intensely acid matter. Increased thirst and large appetite with emaciation sometimes cause a suspicion of diabetes. Whether the disease is ever primary, due to abnormal innervation of the gastric glands, is uncertain. Its connection with gastric ulcer and catarrh has been already noticed. In some cases it has followed an indiscretion in diet[70] or drinking large quantities of cold water.[71] By suitable treatment great improvement usually results; but a complete cure is rare.

III. Catarrhal Inflammation.

There is no affection of the stomach so common as inflammation of the mucous membrane. Diphtheritic or phlegmonous inflammation is, it is true, rare; but so-called catarrhal inflammation is of the greatest frequency. Although called catarrhal, this cannot be looked on as of the same nature as a catarrhal inflammation of the conjunctiva or respiratory mucous membrane; for the mucous membrane of the stomach is not a mere investing membrane, but a mass of glands whose inevitable involvement in any inflammation gives this a parenchymatous character,[72] where not only the connective tissue and surface epithelium are affected, but also the glandular cells. This inflammation is acute or chronic. It is caused by irritants, generally food or drink unsuitable in quantity or quality, by all causes which lead to chronic hyperæmia of the stomach, and by various conditions of the blood, chiefly those in which poisonous matters are excreted by way of the gastro-intestinal mucous membrane, the most ordinary example of which is to be found in cases of chronic uræmia.

The anatomical changes are hyperæmia and infiltration of the mucosa with round cells, increased formation of mucus, and various forms of degeneration of the epithelial cells of the glands. If the disease goes on, a condition of cirrhosis is induced, in which, with atrophy and cystic degeneration of the glands, an increase of connective tissue takes place, frequently associated with pigmentation, polypous excrescences, or even extensive ulceration.[73]

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The general symptoms of gastritis, or, as they are called, acute and chronic dyspepsia, are too well known to need repetition. I shall confine myself to the chemistry of the contents of the stomach. The affection has been divided into simple, mucous, and atrophic inflammation. In the first form the fasting stomach is found to contain scanty remains of food mixed with fluid, containing but little mucus, often mixed with bile and other intestinal contents. After the test meal the acidity is found diminished, ferments scanty, peptonization takes place more or less in the stomach, and the filtrate digests when acidulated.

In mucous gastritis the chief characteristic is the large quantity of mucus found both in the fasting and digesting stomach. The acidity is slight and due to organic acids; free HCl is usually absent. The ferments are present only in traces, and albumen is digested only to the stage of albumose. The filtrate digests after acidulation, slowly and imperfectly.

In atrophy there is little or no mucus secreted. During fasting the stomach is usually empty. After eating there is a complete absence of acid and the ferments, and the filtrate, even after addition of acid in sufficient quantity, shows no digestive power.[74]

In many cases of chronic dyspepsia, heartburn and symptoms of increased acidity are marked phenomena. These are due, not to increased formation of HCl, but indirectly to its diminution, which allows fermentation to occur, the products of which cause the heartburn, acid eructations, flatulence, and many of the other symptoms of which the patients complain. It is true that recently a class of affections have been described as acid catarrhal,[75] in which, even in the fasting stomach, HCl is found, and during digestion in abnormally large amount. The digestive power of the stomach is good, but its mechanical functions are impaired. It does not appear clearly in what these cases differ from those of hypersecretion, and an acid catarrh is not admitted by those best qualified to form an opinion on this subject.[76] In many cases the diagnosis between chronic gastric catarrh and other more serious affections, particularly carcinoma and that form of nervous disturbance associated with arrest of secretion, is very difficult, and to be made only by exclusion. The difficulty and uncertainty are so great that Riegel[77] rejects the heading "Catarrh" alto-

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gether, and classes his cases, which would usually be placed under this heading, as examples of subacute and chronic dyspepsia. That these cases, however, were of different kinds is shown by the fact that while in some HCl was absent, in others it was present in normal amount.

Many cases of atrophy of the stomach have been recently described, and the clinical histories and post-mortem appearances accurately recorded. The very serious symptoms manifested by these patients and the apparently inevitable termination of the disease in death, is a sufficient proof that the stomach has some function more important than that of a mere receptacle or of a disinfector. It is true that cases have been recorded by Ewald and others where patients went on pretty well although there was a constant absence of acid and ferments in the contents of their stomachs. But this satisfactory condition is only temporary; a time comes when the intestine is no longer able to compensate for the loss of the functions of the stomach, and then symptoms arise, often pretty suddenly, which persist with increasing intensity until death [78]—these are gastric pain, loss of appetite, frequent vomiting, profound anæmia—often presenting all the clinical features of progressive pernicious anæmia—extreme feebleness, but often without emaciation. In these cases the diagnosis rests chiefly on an examination of the gastric contents. These are without mucus, the food is after a test meal undigested, there is no hydrochloric acid, and the ferments are absent.

Jaworski [79] calls attention to the importance, when examining the digestive power of the stomach contents, of adding acid until the tests show the presence of free acid. He also advises, before concluding as to the absence of ferments, to introduce into the stomach dilute HCl, which is again withdrawn after a time. By this means pepsin and rennet are sometimes got, which by other methods may appear to be absent. The acid excites the glands to secretion and changes the zymogens into the fully-formed ferments.

In the case recorded by Litten and Rosengart,[80] remarkable for the youth of the patient, who was only eighteen years old, this practice was adopted, with the result that while the stomach contents acidulated after removal had no digestive power, those got by the introduction of acid into the stomach did digest albumen, although slowly; rennet was absent under

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both circumstances. A microscopic examination of the contents of the fasting stomach shows no elements arising from the mucous membrane, but merely granular masses, with bacteria. Jaworski thinks this negative result characteristic of gastric atrophy.

In some cases, besides thinning of the mucous membrane, the other coats of the stomach are atrophied, and the capacity is normal or somewhat enlarged. In others the external coats are greatly thickened, there is a sort of cirrhosis of the muscularis, and the capacity of the stomach is often considerably reduced. In either case the motor function of the organ must be impaired, and to the supervention of this motor insufficiency the omission of severe symptoms is, no doubt, largely due. Litten and Rosengart found, four hours after a small Probefrühstück, remains of food in the stomach, and in other cases a similar delay was observed.

IV. Dilatation.

In no condition has the œsophageal tube been more used than in dilatation of the stomach, and under no other circumstances has its use been attended with greater benefit. Dilatation of the stomach, or gastrectasis, is, however, not a disease *per se*, but only a consequence either of increased obstruction at the pylorus, or of too great a mass to be moved, or of an enfeeblement of the muscular coat of the stomach. It is this want of proportion between the work to be done and the muscular force available to do it that causes the symptoms. Thus in many cases the stomach may be enlarged, and yet the digestion may show no impairment, because the viscus can completely empty itself; while in other instances, although there may be no great distention of the stomach, yet from the insufficiency of the muscular coat serious symptoms may be present, depending on the incomplete emptying of the contents into the intestine. The conditions are, as is well put by Ewald,[81] precisely analogous to those which occur in the case of the heart. Here, from obstruction at the orifice or other cause, considerable dilatation of the chambers may take place; but so long as the muscular energy keeps pace with the obstruction, so long compensation is effected and serious symptoms do not result. But when compensation fails, then the symptoms manifest themselves, and if the muscular tissue is

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much diseased this failure may occur before the dilatation has advanced to any very high degree. It is notorious that in cases of long-standing heart disease compensation sometimes fails quite suddenly, and the same would seem to occur in cases of stomach disease which have been described as instances of acute gastric dilatation.

Those cases, then, in which by the well-known methods the stomach can be shown to have an enormous capacity and to reach below the level of the umbilicus, where after periods of increasing distress large quantities of fermenting matter are vomited in which sarcinæ and many other kinds of organisms are found, are only the last and incurable stage of a condition which, if recognized early and suitably treated, may be arrested in its progress or cured completely. Even in the advanced stage the stomach contents usually contain ferments and hydrochloric acid. Riegel,[82] in 21 cases of dilatation, made 156 observations. In only two of these cases was HCl even temporarily absent, and in not one of them was it permanently wanting. The same observation has been made by Ewald [83] and all other writers on this subject, and I have myself in several instances found that the filtrate of the contents of the stomach possessed pretty good digestive power.

Of the great relief which even in this advanced stage follows washing out of the stomach, the use of antiseptics to check the various abnormal fermentations which take place in it, and the employment of a suitable dietary, it is unnecessary to speak. At best, however, the treatment in this stage can be but palliative.

Of far more interest is it to recognize the earlier stages when the distention is only temporary and inconsiderable, and when the treatment can not only relieve but cure. By no one has this subject been more admirably discussed than by Rosenbach.[84] He points out the difficulty and uncertainty in the diagnosis of enlargement of the stomach depending partly on the normal variations in the size of the organ in different individuals, and partly on the difficulties in the methods of examination. He shows that serious symptoms may be present where there is no dilatation, and that, on the other hand, dilatation may be present and yet these symptoms may be absent; that it is, as stated above, the want of proportion between the work to be done and the energy available for its

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performance that is the essence of the disease, and this he calls "Magus-insufficienz," or "gastric motor insufficiency." The causes of this are various. Some are congenital, as narrowing of the pylorus or abnormal positions of the stomach. It has many times been observed in association with movable kidney on the right side, although the connection between the two is not altogether clear. It is often due to hypersecretion or hyperacidity, which interferes with the digestion of carbohydrates, and possibly causes a spasmodic closure of the pylorus; chronic gastritis extending to the muscular coat will enfeeble this. But probably the most common cause is unsuitable food—food of an indigestible character, eaten hastily without sufficient mastication, and, above all, eaten in too large quantities at a time. In all these cases the food is too long retained in the stomach, and a too frequent repetition of this will infallibly lead to gastric dilatation.

Many ingenious methods have been devised for the detection of this motor insufficiency of the stomach. Of these one of the most ingenious is the salol method of Ewald and Sievers. Salol,[85] a phenyl ether of salicylic acid ($C_6H_4OH\ COO.C_6H_5$), is not decomposed in an acid medium, but in an alkaline medium is split into phenol and salicylic acid. The latter is excreted in the urine as salicyluric acid, and is readily recognized by the purple color it gives with neutral ferric chloride. Ewald and Sievers found that when one gram of salol was given with food the reaction manifested itself in the urine in from 40 to 60 minutes, latest 75 minutes. If it was later it appears it showed that the contents of the stomach were too long retained. As to the value of this method opinions vary. Huber[86] finds that even in healthy persons the reaction is often very late to occur, and thinks that the time of the first appearance of the reaction is of less value than the time of its disappearance. In normal stomachs this is 27 hours at latest after taking the drug, while in cases of motor insufficiency the reaction is found from 33 to 48 hours, the duration being in proportion to the insufficiency of the stomach. Pal,[87] however, in a number of carefully-conducted experiments, finds that even in cases where, as proved by the stomach-pump, the contents of the stomach pass normally into the intestine, the salicylic reaction in the urine may persist for even 72 hours. Its persistence seems to depend more on the deficient mobility

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of the intestine than on that of the stomach, since it was much greater when the bowels were constipated than when the stools were normally passed.

The method of Klemperer consists in injecting into the previously-washed-out stomach 100 c.c. of olive oil and withdrawing what remains after two hours. This is a method which evidently is not of general applicability, and cannot be safely used in all cases.

The most certain and ready way of seeing whether the stomach empties itself normally is, unquestionably, to pass a tube and determine what remains in the organ. If 5–6 hours after a full meal the stomach is found empty, then the motor function is normal.

The length of time during which matters will lodge in the stomach is almost incredible. I have myself washed out of a dilated stomach a quantity of charcoal which could not have been taken later than 10 days before, and that although almost every day in the interval vomiting had occurred. In cases of motor insufficiency the treatment is evidently chiefly to be directed to sparing the muscular coat. A diet easy of digestion, and, above all, taken in very small quantities at each meal, are the chief points to be attended to. Of the value of massage and electricity much doubt may be entertained.

V. Nervous Dyspepsia.

Under the term nervous dyspepsia Leube[88] described a condition met with most commonly in young persons of the upper classes. In many such, soon after eating, nervous symptoms appear, such as congestion of the head, stupor, inability to work, fulness in the epigastrium, eructation of scentless and tasteless gas. Vomiting is rare. These symptoms, which are often associated with other nervous manifestations, are not due to any disturbance in the chemistry of stomach digestion, nor to impairment of its motor functions. They occur too soon after eating to be explained by absorption of abnormal products of gastric fermentation, and an examination of the contents of the stomach during digestion shows that the acids and ferments are normal, and that the organ is empty within 7 hours after eating. It is assumed that the symptoms are of a purely nervous character, and due

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to an abnormal sensibility of the nerves of the stomach to the mechanical irritation of the food.

Riegel[89] in his first report gives the results of 68 observations on 16 cases. In all free HCl was found, and the peptic power of the stomach contents was normal.

In his second report[90] he gives 28 analyses from 9 cases. In all of these the duration of digestion was normal, and in 8 the chemistry was normal, while in one case a transitory and slight hyperacidity, due to excess of bile, was noticed. Riegel, however, thinks the term nervous dyspepsia should not be absolutely restricted to such cases, since it is quite conceivable that a disturbed secretion of the stomach may arise from a purely nervous cause, and that in a purely nervous way not only sensory but secreting and motor abnormalities may arise.

Ewald[91] calls attention to the imperfection of our methods of chemical observation, and adduces cases of a decidedly nervous character in which alterations of the chemistry were found, and also cases of unquestionable catarrh, ulcer, and carcinoma, in which the gastric juice was found normal. Further, he quotes from Leube himself cases of nervous dyspepsia in which, seven hours after eating, the food was undigested and no acid was present; while cases of catarrh, ulcer, and carcinoma have been observed in which, at this period, the stomach was empty. Hence on an examination of the contents of the stomach too much weight must not be placed. He calls attention to the frequent association of intestinal symptoms with those referable to the stomach—constipation, flatulence, severe pains in the intestine, and sometimes tenderness. He proposes to substitute for the term nervous dyspepsia neurasthenia gastrica, or neurasthenic dyspepsia.

The observations of Jürgens, who found in many cases of dyspepsia, with vague symptoms, extensive degeneration of the nervous plexuses of the stomach and intestine, and also diseases of the smaller vessels of these parts, show that we must not too hastily conclude that a mere functional disturbance exists because on superficial examination no discoverable anatomical basis for the symptoms presents itself.

It would appear, indeed, that the diagnosis of nervous dyspepsia is by no means an easy matter, and must rest, not so much on exact observations with the stomach-pump as on the general character of the symptoms, their variability, their

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association with other nervous manifestations, the absence of symptoms pointing to other well-defined disorders—as ulcer, carcinoma, and catarrh, and the results of treatment.

Herzog[92] has recently examined 14 cases in order to see whether by a careful investigation of the mechanical and chemical processes during digestion precision in diagnosis could be attained.

The motor activity was tested by Klemperer's oil-method —the chemical by the usual methods—after a test-meal. In 9 cases motor insufficiency was found—that is, after two hours too much oil was still found in the stomach. Of these, 5 showed hyperacidity, 3 normal acidity, and 1 subacidity. These are three stages which follow necessarily from motor feebleness. They may occur in other conditions, as catarrh, and have consequently nothing characteristic of nervous dyspepsia.

Of the remaining 5 cases which showed good motor power of the stomach, 4 manifested hyperacidity, 1 normal acidity, and none subacidity.

He concludes that the differential diagnosis of nervous dyspepsia from other diseases of the stomach cannot be made by means of an examination of the gastric contents, since all the results got in this condition may be met with in cases where there is anatomical basis for the disease. The difficulty of distinguishing between catarrh and the neurosis is peculiarly difficult, and depends chiefly on the history of the case.

VI. Secondary Disturbances of Digestion.

In conclusion, I shall notice the disturbances of digestion which occur in some diseases other than those of the stomach. This subject is of great importance, and has hitherto received far less consideration than it merits.

1. *Phthisis.*—The great frequency with which dyspeptic troubles complicate the course of phthisis is well known. Not uncommonly the first symptoms of the disease are referred to the digestive organs, and a perhaps exaggerated importance has been assigned to this so-called pretubercular or strumous dyspepsia. Even in cases where such an early occurrence of dyspepsia does not occur, as the disease goes on, sooner or later, loss of appetite, vomiting, fulness and weight

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after food, coated tongue, and other symptoms of stomach derangement show themselves, and every one knows what a serious complication they are and how unfavorably they influence the prognosis. It is consequently not to be wondered at that many investigators have studied the course of the digestion in phthisical patients by the improved methods of recent research.

Rosenthal [93] found a constant absence of HCl in the stomach contents of 6 phthisical patients at different stages of the disease, all more or less febrile. None of these patients complained of special digestive trouble, and most of them had good appetites.

Herzog,[94] on the other hand, found in 8 patients HCl constantly present—often in relatively large quantity; but in all cases he found the motor power of the stomach enfeebled, and to this he attributes the loss of appetite and other gastric difficulties.

Schetty [95] examined 25 cases without selection—men and women, in early and late stages of the disease, with and without fever. He found HCl always present—sometimes increased—and also found that the stomach was empty six hours after the test-meal. Only in 3 cases was a small quantity of fluid present without remains of food. He hence concludes that the secretion and motor power of the stomach are normal. In most of the cases there was only disinclination for food, while in some the appetite was good.

Klemperer [96] observed 14 cases. These he divided into cases of initial and those of terminal dyspepsia. The former are characterized by heartburn, eructations, sickness, fulness in the stomach, tenderness on pressure, vomiting induced not by food, but by attacks of cough. The appetite is variable and capricious. In the case of terminal dyspepsia the appetite is completely lost, there is no variation in the symptoms, there is little heartburn or eructation. Vomiting is independent of the cough, occurs every two or three days, and is abundant. The stomach is often considerably dilated, while in the initial stage it is of normal size.

In the initial stage the secretions of the stomach are normal, often with increased formation of HCl; but there is distinct enfeeblement of the motor activity. It is true that the stomach is often empty seven hours after a meal, but by the

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oil-method a motor insufficiency can be detected. In the terminal stage the HCl is greatly diminished or absent, the organic acids increased, pointing to abnormal fermentation, while the motor insufficiency is pronounced. The symptoms in the initial stage resemble those of the so-called nervous dyspepsia, while in the terminal they resemble those of carcinoma or atrophic catarrh. They have nothing characteristic for phthisis, but are merely the expression of a subacute and chronic gastritis. The primary condition is motor feebleness; this, after a time, is followed by hyperacidity, probably from the irritation due to the too long delay of the food in the stomach. Finally, this leads to interglandular changes in the mucous membrane and such anatomical alterations as to cause cessation of secretion and ectasy of the stomach.

Brieger[97] seems to have met with positive results more generally than other observers. He examined 64 cases of phthisis in different stages of the disease.

Of the advanced cases only 16 per cent showed a normal secretion, while in 9.6 per cent there was a complete disappearance of the normal products of secretion.

In cases of medium severity 33 per cent had normal secretion, while in 6.6 per cent the secretion was entirely absent.

In the early stages there were about equal numbers with normal and altered secretion.

In general the motor power and faculty of absorption were altered in proportion to the alterations of the secretion.

The changes are not specific, but depend on a chronic gastritis passing on to atrophy.

Hildebrand[98] finds that the fever has considerable influence on the secretion of the stomach. When fever is constant HCl is always absent, and when fever is variable so is the HCl. A rise of temperature to 37.8° C. (100.4° F.) causes the acid to disappear.

Immermann[99] examined 54 cases, and in 51 found the stomach empty after the test-meal. In those cases where matters were still present the patient enjoyed good appetite and made no complaint of his digestion. It is consequently concluded that in those cases where true gastric dyspepsia exists, this is to be looked on as a complication and not as an essential part of the phthisis.

Schwalbe[100] has studied the anatomical conditions of the

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stomach in 25 fatal cases of phthisis. In only six instances was it found healthy. In the others the changes were: slight generalized interstitial inflammation, 9 cases; round-celled infiltration, 5 cases; amyloid degeneration, 1 case; and fatty degeneration of the glands, 4 cases. On the whole, the changes were not of a very severe character, or such as to impair considerably the secretion of the organ.

The differences in the results arrived at by the different observers are instructive, and show that there is no universal condition of the digestive organs in phthisis. Furthermore, the fact that the subjective feelings of the patient do not invariably correspond to his digestive powers, as tested objectively, indicates that in phthisis, where a good nutrition is of such vital importance, the patient's feelings or desires are a fallacious guide, and in regulating the amount and quality of the food we should, wherever possible, examine into and take account of the digestive function as experimentally determined.

2. *Heart Disease.*—In cardiac disease the stomach shares in the general venous congestion, and digestive troubles are a common and serious complication of these distressing affections. Only a small number of observations has as yet been made on such cases. It has recently been shown that while starch and albuminous food are well absorbed, fats are very imperfectly taken up from the intestine.

Hüfler found in 8 cases, seven times want of HCl in the stomach and once hyperacidity, consequently never a normal condition.

Quite different are the results arrived at by Adler and Stern,[101] who, in 20 cases, found HCl constantly in 16, inconstantly in 2, never in 2. Seven patients had digestive difficulties. Of these 4 had constantly free HCl, 2 inconstantly, 1 never. The other patient, who showed a constant deficiency of HCl, enjoyed subjectively a good digestion.

Here, then, we have the same state of things as in phthisis, and may draw from them the same conclusions. Grassmann[102] has found that in cardiac cases, while carbohydrates and proteids are well absorbed, fats are taken up very imperfectly, and appear in the fæces in abnormally large proportion. This defective absorption is due to chronic changes in the mucous membrane of the intestine, and is not found only in those

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instances where compensation is markedly deficient. The chronic catarrh of the stomach, which accompanies cirrhosis of the liver, is well known. How far this is due to the alcohol which commonly causes the hepatic affection, and how far to the venous congestion consequent on the partial obstruction, is not always easy to say.

3. *Kidney Disease.*—In kidney disease vomiting and other dyspeptic symptoms are almost constant, and constitute in some cases the most prominent features of the case. Biernacki [103] has examined six cases of subacute and chronic parenchymatous nephritis, with more or less œdema, and a considerable amount of albumin in the urine. The HCl was always much diminished, and in most observations absent. Lactic acid was in small amount, and pepsin greatly diminished, notwithstanding the motility was found to be unimpaired.

Fenwick [104] finds that similar changes occur in the glands of the stomach as those which occur in the kidneys, and concludes that the stomach has the power of excreting certain poisons, among which is urea; that by this an acute catarrh of the glands is caused. The vomiting in chronic renal disease he attributes to chronic gastric catarrh, and thinks that true uræmic vomiting occurs only in acute suppression of urine.

4. *Diabetes.*—Rosenstein [105] has made observations in ten cases of diabetes. In four of these the stomach contents were normal, in the remainder abnormalities were found. In some the HCl was absent for a longer or shorter time, and then returned. This he looks on as a neurosis, and he finds that, like the absence of patellar reflex and other neuroses, it has no direct relation to the severity of the disease as measured by the amount of sugar passed, or by the presence of acetone or diacetic acid.

In some cases, however, the HCl was permanently absent, and this is attributable to an atrophy of the mucous membrane depending on interstitial inflammation.

Gans [106] finds that the conditions are exceedingly variable in different individuals (normal secretion, hyperacidity, and diminution, or complete absence of HCl), and in the same individual at different times.

The motility was found always intact.

There was no relation found between the severity and duration of the disease and the condition of the stomach.

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He thinks the deficient acid is more probably to be attributed to inflammation caused by excess in eating or drinking than to a neurosis.

Hirschfeld,[107] who has made a study of the metabolism of diabetic patients, describes a variety of the disease in which, while carbohydrates are all absorbed, the absorption of proteids and fats is exceedingly defective. In such cases the functions of the stomach and intestine must be performed in a very imperfect way.

These few examples will show what a fruitful field of investigation is to be found in a study of the chemistry of stomach digestion in diseases which do not primarily affect the digestive organs.

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UNSOUNDNESS OF MIND,

IN ITS

Legal and Medical Considerations.

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UNSOUNDNESS OF MIND.

CHAPTER I.

WHEN Beccarria observed, "The happiest of all nations is that in which the laws have not become a science," we are almost disposed to suspect that he had been studying the question of unsoundness of mind in its relation to responsibility for criminal acts: certainly to no subject is the remark more applicable; for, between the diversity of medical doctrines, antagonism of legal opinions, uncertainty and difficulty which have been manifested in determining the majority of cases which the records of criminal jurisprudence supply, the student is led to the conclusion that on this particular subject the lessons of experience have been strangely lost sight of, and many doctrines perpetuated with inexplicable pertinacity, in direct opposition to ordinary rules which in every-day affairs of life regulate the conduct of men.

Was the question of unsoundness of mind a purely legal problem, one could well understand the advantage to be derived from the retention of the opinions of those whose erudition and intelligence have dignified and shed a lustre on the bench. Was mental disease of necessity associated with appreciable structural change, it would be but natural to expect that, as a capability of ultimate analysis progressed, accuracy in the formation of opinions would have been proportionately attained. Could the mind be regarded as a series of simple, untangible creations, which, though immaterial and beyond reach, were still recognizable by the uniformity of certain operations—in abstract reasoning on the manifestations—inductive eclecticism, the question of mental soundness and responsibility would rest. But, as every day's experience has established that it is not so, and that, spite of all modern

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aids, diagnosis is still at fault, it is necessary in all humbleness to forget much of what has been written; for, however we may reverence the ability, or honor the learning of certain great authorities, we must not, in deference to them, permit ourselves to be led from real to logical relations, from particular into abstract considerations, to form general from special rules, or be induced to afford to the arbitrary combinations of their intelligence that impress of reality and unity which the contemplation of an individual case denies.

We believe that a want of harmony must ever exist between the legal and medical doctrines of insanity in its connection with responsibility. The two cannot be identical, and for this reason: Law demands a fixed rule—medicine admits but a general principle. What would be thought of the physician who undertook in the definition of any, even the simplest disease, to say, "Certain symptoms must be present?" His theory would lead to a series of disappointments, his practice be a continuation of blunders! Yet, law steps forward with her definition of unsoundness of mind; and, according to this definition, on which both the life and reputation of society may depend, one half mankind are mad, and half the mad are wise. Divest the mind of the body, establish a common standard of mind for man, and then propound a legal definition: make every question of right or wrong a simple proposition in metaphysical science; with Locke investigate the principles of our knowledge, or with Reid scrutinize the principles of our minds, and, irrespective of other considerations, let every departure from the acknowledged standard be a crime, and every crime bring its responsibility, then, and not until then, can law assume the province of the physician: while we acknowledge the humanity of man, and admit that his physical organization influences, not only the development, but also the healthy exercise of his mind; while we recognize the capability of experience to establish certain relations which every power of conception founded on that experience approves; without much violence to language or reason we may, for all practical purposes, regard those relations as necessary, and find in their study just grounds for inductions, be they on questions of medicine or of law.

In medicine, as in the other sciences, all propositions become not only untrue, but inconceivable, if necessary axioms

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be disregarded in their enunciation: the chief characteristics of a sound induction being, first, its ready identification with observation of facts; and second, the capability it affords of predication. The law in laying down a fixed rule by which to recognize unsoundness of mind, as also responsibility for crime, is daily opposed by observation, and seeks to establish a dictum that would, were it acted on, lead to perpetual error: it may be presumed its hypothesis cannot be true, since the experience which its deductions afford are at variance with the reality of nature.

Though for judicial purposes no other course is practical, yet in its operation, when necessity arises, and special facts in evidence are considered, the observation of Lord Cairns in Fulton v. Andrew[1] not unusually prevails: "I should in this case, as indeed in all others, greatly deprecate the introduction or creation of fixed and unyielding rules of law which are not imposed by acts of Parliament." Merits rather than technicalities influence the judicial mind, and so bridge over many otherwise impassable difficulties.

Much of the diversity and uncertainty of opinion which pervades medical writings and characterizes legal doctrines is owing to the identification of physic with law. Insanity is, or is not, a disease! If it is not a disease, the law is strangely defective: since, as the late Dr. Forbes Winslow in his admirable writings on this particular subject has clearly and ably shown, no two lord chancellors have agreed respecting its constitution: and, not only this, but they have in their separate opinions, with considerable acrimony, criticised each other's judgments. Thus, in the trial of the case Bainbrigge v. Bainbrigge, Lord Campbell, in 1850, distinctly states, "There may be mania without delusion;" while Lord Denman, in his charge to the jury in the case Regina v. Smith, had observed in 1849: "To say a man was irresponsible, without positive proof of any act to show that he was laboring under some delusion, seemed to him to be a presumption of knowledge which none but the great Creator Himself could possess." Again, Lord Campbell, in a debate in the House of Lords,[2] after alluding to his "very long and very large attention to the subject," said "he had looked into all the cases that had occurred since Arnold's trial, 1723, and to the directions of the judges in the case of Lord Ferrers, Bellingham, Oxford,

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Francis, and M'Naughten, and he must be allowed to say that there was a wide difference, both in meaning and in words, in their descriptions of the law." We may add to this, the aggregate opinion of the fifteen judges, who decided, in 1843, that "before a plea of insanity should be allowed, undoubted evidence ought to be adduced that the accused was of diseased mind, and, at the time he committed the act, he was not conscious of right and wrong." Hence, though a man be of a diseased mind, if he is conscious of right and wrong, it follows that he must be considered as responsible. Medical experience makes one part of this proposition oppose the other; and as a consequence, establishes its inefficiency; for, in the knowledge of right and wrong is merged the question of diseased mind. Those who so argue assume an antagonism, which, though not infrequent, is by no means necessary; for, while perfectly sound minds may disregard the criminality of a particular act, and deliberately say, "Evil, be thou my good;" a distinct knowledge of the criminal nature of that act can co-exist with a mind thoroughly deranged, and incapable of self-direction or control. This want of identity between legal and medical opinions occasionally inspires those entertaining conflicting views with unseemly comments, each against the other, as if men of high character in either science acted otherwise than under a sense of public responsibility and professional duty. Such are ever to be regretted. In law as in medicine, occasions arise when the limit of the knowable is reached, and judges with juries, where physicians differ, feel in reference to legal dicta—it is "the letter that killeth, while the spirit giveth life."

It would not be difficult to adduce abundant proofs of the danger which might result from receiving without question the authoritative conclusion that "nothing could justify a wrong act, except it was clearly proved that the party did not know right from wrong." "Father, forgive them, they know not what they do," was an interceding cry in extenuation of the greatest recorded crime. "But I obtained mercy," adds St. Paul, when detailing his misdeeds as a blasphemer, a persecutor, and an injurer, "because I did it ignorantly in unbelief." In accordance with these precepts, ignorance of the nature and consequence of a particular act has ever been received as a plea in mitigation of its punishment. Who will

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seek to question the validity of such a judgment? It invites philanthropists to consider the condition of the uninformed masses—human animals—without the controlling influences of religion or education, and to determine what should be the relations between their punishments and crimes. While thankfully acknowledging the diminution of crime consequent on the spread of education—to say that a knowledge of right and wrong entails, on the one hand, the capability of acting according to that knowledge; or, on the other, indicates a sane state of mind in reference to those acts respecting whose nature that knowledge is evinced, and therefore involves responsibility for crime; is to contradict the dictates of medical reason, and opposed to the admitted evidence of legal experience.

It would require but little industry to enumerate a host of discrepant opinions on the subject of unsound mind, and demand less observation to establish their inefficiency; for such opinions would be found on investigation to be so far partially true, that they notice frequent phenomena which arise in mental diseases; yet to be in error, when they presume the presence or absence of any one of those phenomena, as essential for the diagnosis of such diseases.

Admitting it as for the present conceded, that the law has failed to satisfactorily meet the question under consideration, wherein rests the cause of its inability to do so? A little reflection will show that it is in the complex nature of the inquiry at issue. Accordingly, that we may be the better prepared to entertain the various propositions such investigations offer, let us institute a brief analysis of—

1st. Those ethico-legal considerations which determine the facts of criminality.

2d. Those psycho-ethical relations which are involved in the question of psychical freedom.

In their estimation of the first, the physician and lawyer may join hands, each having the same fixed rules for their guidance; since, as Lord Mansfield has observed, "Every person was supposed to know what the law is." In their opinions respecting the latter, physicians are called on to declare how far that association, which observation points out as existing between the mental and physical constitution, is adequate for the explanation of certain phenomena, attributed

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to disease, but apparently identical with crime. Though it be essential that the physician have his mind thoroughly impressed with the true association between ethics and law, in order that he be the better enabled to estimate the question of mental soundness in its relation to crime; it is above all things important, that in his professional opinions he abstain from outstepping the bounds of medicine, which fully consigns to juries, under judicial direction, the appreciation of the first, while equally questioning their capability without expert evidence of adjudicating on the second.

It may, *in initio*, be observed, as a fact no less humiliating than true, that it not infrequently occurs, when the most important cases come to be decided, there is a direct antagonism in the views of "the highest authorities" on legal as on medical points; unhappily proving that the soundness of an individual's opinion is not always proportionate to the greatness of his genius. In the former, previous to those reforms which no longer permit subtle technicalities to over-ride substantial claims, justice was too often baffled by forms and procedure. Cases over-ruled, and now disregarded, show how much injury had been thereby inflicted. Judgments resting in deductions from precedents cribbed and confined within the rules of special pleading. Law in its advancing wisdom has long shaken off all such restrictions, and goes to the "very right" of matters in dispute. Can the same be said of medicine? We fear not! How numerous are the medico-legal investigations in which, even now, when life or property is at stake, the highest authorities are arrayed against each other, and conflicting opinions discredit the evidence of experts, leaving the judge to direct the jury, as his trained mind may enable him to eliminate truth.

If we scrutinize the cause of this diversity of opinions, it will appear that in many instances it has proceeded as much from the imperfect means generally applied for their elucidation, as from the obscurity of the subjects, and further, that the partial and one-sided view of nature which some have advanced, with more show of eloquence than force of reasoning, at once fails before the test of experience, and the application of those principles which, in psychical as in physical medicine, render comparison the only safe guide for the establishment of eclectic observation, or the formation of a just diagnosis.

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This capability of comparison is by far the most valuable of all the aids which the physician possesses, since by it he is enabled, not only to estimate the relation an altered structure may bear to an admitted standard, as counsel determine the relation of a particular act to the known law; but also, when observing the varying phenomena incidental to the structure itself, to speak with confidence on the presence or absence of certain conditions which experience suggests as their usual, if not necessary, accompaniments. The first demands, on the part of the investigator, a perfect acquaintance with the several criteria of health as well as of disease which are applicable to all. The second implies successive observation of the individual; or the acquisition of an abstract experience, for the just appreciation of special physical and vital phenomena in their individual association, the capability of perfecting which is in a ratio to the discriminating power of the physician. These principles, as applicable to mental disease, have found adoption in the judgment of Lord Penzance in the case of Smith v. Tebbett,[8] when he approves the observation of Dr. Ray: "Compare a man with himself, his acts and thoughts now with his acts and thoughts at some previous period, when his mind was in undoubted health, you will the better detect what is morbid, than if you set up a general comparison with the thoughts and acts of mankind."

In the investigation of organic disease, with all the aids which modern diagnosis affords, a most accurate observation may prove inadequate to the solution of certain problems in which ordinary rules appear not only to be disregarded, but anomalies to exist, requiring for their explanation the inferential rather than the direct application of established principles. The causes which lead to this embarrassment it is not our province to enter on; but recognizing the fact that in identical organizations similar changes are manifested by the most diversified and conflicting symptoms, it is the less surprising that the mental constitution, which may be regarded as a series of progressive developments, should, for its due appreciation, be beset with much greater difficulties, and in its irregular operations manifest such diversity as, while altogether confounding the ignorant, too frequently present an enigma to those whose lives and energies have been devoted to the scientific study of so-called mental disease.

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It will hereafter be sufficiently evident that a greater error does not exist than the supposition that the investigation of soundness or unsoundness of mind comes equally within the range of the ordinary judgment, as the determination of the criminality of a particular act when such act is contrasted with the known law. They who think so lose sight of the great practical truth that while the latter is within the reach of all intelligent men, the former, more particularly when considered in its criminal bearings, requires not only a deliberate exercise of the specially-educated intelligence, but also a competency to justly estimate the value of facts, not in their usual but abnormal relations. Wanting this capability of establishing the psychical associations of acts regarded as crimes, the frequent absence of which the records of criminal jurisprudence disclose, we are constrained to believe that life and reputation have been at times sacrificed to the erring vengeance of the law, rather than confided to the guarding care of the physician.

While this want of unity between law and medicine continues, the most that can be hoped for is as close an approximation to justice as human institutions admit of: when the fixed standard of law and the variable standard of medicine afford, in the public interest, mutual protection against impunity to acts, seemingly crimes, or their undue punishment.

Considering laws as the matured offspring of political and social science, the result of observation and experience, the perfection of reasoning on existing data, and the consummation of the conclusions which those data have afforded—we are prepared to recognize the fact that with the progress of civilization in separate countries, and the variety of relations in which men are placed with respect to each other, the data being different, the laws which they generate also vary; so much so that practices regarded as heroic and virtuous in one country would be stigmatized and held to be criminal in another. The same observation is alike applicable to each country which, as its prosperity and intellectual progress—identified as one is with the other—advance, has the effect of introducing fresh intellectual pursuits, as the study of new sciences demonstrates the wants or inefficiencies of the old. Our intellectual and social condition being progressive and dependent on the suggestions of individuals, it becomes of the

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first importance that for the well-being and safety of society there be fixed principles to guide and govern the movements of the whole; the infringement of which should entail such responsibility as the well-being of the community might necessitate.

The decalogue has enumerated certain offences as entailing the wrath of God. The Scriptures have offered an unerring rule to direct the conduct of man. Were religion universally felt, and the spirit of Christianity equally experienced by all, other guides would be needless. As, however, it is not so, society has promulgated her own codes, taking as her basis that revealed principle which marks the difference between right and wrong, so identifying the moral and intellectual faculties in their co-operation. How far these exist independently, and thus correct or antagonize—how far they are identified, and so uphold and advance each other—is an inquiry which subsequent investigation shall enter on.

Human legislation has its moral and civil obligations: the former, having as their basis divine command, are unchangeable; while the latter depend for their integrity on variable foundations. It follows as a natural law that, according to our estimation of the principle which guides the greater obligation, responsibility for the observance of the several requirements of the lesser should be determined. This we find to be practically the case; for though, in the construction of all laws, the actions rather than the motives must constitute the test of crime—since it would be impossible to frame rules generally applicable to the human heart, its secrets being open to divine scrutiny alone—yet, in the individual application of the law, the act committed is of secondary importance to the motives which induced it, because the latter not only establish an accordance of phenomena as regards the act, but also indicate the intellectual condition from which the act, as the result of the conjoined mental and moral powers, may have originated.

It is for the appreciation of this intellectual condition the evidence of the physician is required—the psychical as contradistinguished from the legal or logical estimation of motives. He is not called on to declare whether an action be judicious, politic, or useful; whether the motives which prompted it be legally justifiable or otherwise; but to say, have those motives

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emanated from a mind sufficiently free from disease as to argue a capability of fully exercising healthy volition, even though, in yielding to the frailty of human nature, that volition eventuates in vice; or, in following the dictates of an apparently laudable ambition, leads to the commission of acts in direct antagonism to the law?

Were medical men to regard freedom from crime as being established by virtue of the purity of motives, excellence of reasoning, or amount of good to be accomplished by acts not consonant with existing legislation, the standard of justice would be soon reduced to the narrow limits of individual opinion and all principles of rule be at an end. In their estimate of such matters physicians do not possess greater advantages than appertain to equally well-educated and intelligent men. Their duty rests in investigating, not only the relation of the act to the law, but that of the motives which originated it to the mind of the individual. The ethico-legal considerations belong to the jury; the psycho-ethical to the physician. The former are capable of being determined by all admittedly rational men, and imply—

1st. The relation of two given data—the act committed, to the known law.

2d. The estimation of the personal or other advantages or disadvantages resulting from the commission of that act.

Physicians associate these relations with a third or variable power—disease—whose proper estimation demands an intimate knowledge of principles which, so far from presenting any analogy, are, it might be affirmed, almost diametrically opposed to abstract legal dicta.

The question of criminality, simple as it may appear, is one by no means so easy of solution as first impressions would imply. If the identification of ethics and law be assumed, immorality and illegality become synonymous terms, and imply a perfection in human contrivances which, it is no very heavy reproach to say, they can never hope to attain. If, on the other hand, we permit the observance of the law to depend on the estimation of each individual, we are forcibly reminded of the observation of Cicero, that "in philosophy there was no opinion so unreasonable as not to have found some defenders;" from which it might be inferred that in popular movements no proposition could be so outrageous but many would freely

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accord to its adoption. Of this, unfortunately, there are abundant illustrations. It is essential for the well-being of us all that the equilibrium of social life be preserved; and that, regarding illegal as distinguished from immoral acts as crimes, no amount of sophistry, or apparent wisdom, absolves the offender from the responsibility his conduct may entail, unless it be proved that the psycho-ethical, as contradistinguished from the ethico-legal, relations of the act were such as to warrant the belief that the offender was, at the time of its commission, laboring under unsoundness of mind controlling the healthy exercise of his volition.

This phrase must not be misunderstood. The *mens sana in corpore sano* has become an aphorism, and yet *mens* and *corpus* at times seem to have an independent existence. Insanity may co-exist with apparent physical health; and physical disease terminate life without impairment of mental soundness. By healthy exercise of volition it is desired to convey that action of the mind in which the harmonious co-operation of the faculties is preserved; mind and body in their relations being both free agents. In such a case responsibility may be fairly presumed to follow on action.

Ethico-legal considerations invite to a wide and almost endless field for discussion, and embrace some of the most interesting problems in social and intellectual progress. It cannot be denied that, friendly as ethics and law are to each other, they do not always admit of being brought into close apposition. History affords many instances in which the scaffold has become the altar where justice wept for blood shed, and offences against the law were sacrifices to virtue. Those examples, though happily being exceptions to the general rule, establishing the possibility rather than the probability of similar events, have, by some, been advanced in extenuation of acts subversive of just government, and abhorrent to right-thinking men; therefore it is all are interested in having the ethical relations of the law so fully understood that society may be guarded against the excitable and ephemeral ambition of such a class of offenders as M. Georget and Dr. Belhome have well described; with whom, as the latter observed, there is often "but one step from exaltation of mind to alienation." All must subscribe to the truth that "in policy as in architecture, the ruin is greatest when it begins

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at the foundation;" the foundation of society being in its laws, public safety demands that they be maintained. The remarks of Dugald Stewart on this point are of the deepest importance to those engaged in the psychopathic study of crime. He thus writes:

"For is it at all consonant with the other arrangements so wisely adapted to human happiness to suppose that the conduct of such a fallible and short-sighted creature as man would be left to be regulated by no other principle than the private opinion of each individual concerning the expediency of his own actions?—or, in other words, by the conjectures which he might form, on the good or evil resulting on the whole from an endless train of future contingencies? Were this the case, the opinions of mankind respecting the rules of society would be as various as their judgments about the most probable issue of the most doubtful and difficult determinations in politics. Numberless cases might be fancied, in which a person would not only claim a merit, but actually possess it, in consequence of actions which are generally regarded with indignation and abhorrence; for unless we admit such duties as justice, veracity, and gratitude to be immediately and imperatively sanctioned by the authority of reason and of conscience, it follows, as a necessary inference, that we are bound to violate them, whenever by doing so we have a prospect of advancing any of the essential interests of society; or (which amounts to the same thing) that a good end is sufficient to sanctify whatever means may appear to us to be necessary for its accomplishment. Even men of the soundest and most penetrating understandings might frequently be led to the perpetration of enormities, if they had no other light to guide them but what they derived from their own anticipations of futurity. And when we consider how small the number of such men is, in comparison with those whose judgments are perverted by the prejudices of education and their own selfish passions, it is easy to see what a scene of anarchy the world would become."

From the uncertain and imperfect views entertained by many respecting the pathology of mental diseases, much of this difficulty which exists in determining the psychical relations of crime has arisen. Those who are unacquainted with the true progress or nature of insanity seek to ignore its pres-

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ence unless it be accompanied by positive evidences of material disarrangement: regarding disease as an active agent whose exposition necessitates physical changes, they demand further proofs of its existence than such as are derivable from actions admitting, as they assert, of conflicting explanations. This class of observers confer an unlimited power upon organic construction, and place out of their account of causation everything beyond the material fabric. The mind of man is, according to their theory, a "principle of combination, resulting from the juxtaposition of attracting particles." This philosophy teaches its votaries to regard crime and disease as differing only by name, and leads us to equally commiserate moral ill and mental alienation, since criminality is thereby resolved into an act of organic necessity; when, as Dr. Barclay so eloquently observes, "thoughts and actions, however criminal, are, like Spartan thefts, to be held disgraceful only if detected." They who hold such a doctrine shut their eyes to the fact that intellectual freedom, which, according to their views, should be but a subtler automatismus dependent on purely mechanical arrangements, soars above those laws which regulate simple organism, and is alike manifest in conditions almost diametrically opposed. Equally in extremes there are others, who affirm the perfect independence of mind and body, and will not admit the close relationship between the immaterial principle and material organization. Such theorists in disease see only vice, and for its cure must therefore advocate exhortation alone. These, with the illustrious Stahl, contend for the existence of an invisible cause, which, irrespective of organism, is manifest in intellectual operations, and entails the necessity of seeking metaphysical explanations for numerous phenomena. The advocates of either of these extreme opinions are each enabled to adduce many cases apparently corroborative of their special doctrines: zeal supplying all that may be deficient for argument. It will be seen how far investigation has cleared up this difficulty. "Lunatick," observed Lord Hardwicke in Barnsley's case,[4] "is a technical word, coined in more ignorant times, as imagining these persons were affected by the moon, but discovered by philosophy and ingenious men that it is entirely owing to a defect of the organs of the body." Science, with its advancing experience, has prepared the way for the question which follows, almost as an

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alternative proposition: "Whether," Dr. Duncan writes, "spiritual existences are really capable of undergoing any alteration in their condition at all analogous to the diseases which affect the corporeal organization, is an inquiry we are altogether incompetent to decide in our present state of existence." Wanting this capability, and admitting mental operations to be intangible, it is only by a process of analogy unusual mental manifestations can be called disease; in the treatment of which, were they immaterial, and thus beyond medical reach, the office of the physician would be of secondary, if of any, importance. Present inquiry does not call for an investigation of this disputed point, further than it is involved in the question of psychical freedom. Adopting in a measure the views of the first school, we allow the fact to be a particular truth which experience has established, that every neurosis is not of necessity a psychosis, as is witnessed in the wide class of the neuralgia, and many affections specially denoting a morbid condition of the nervous centres: on the other hand, however disposed to concede that the mind in its operations seems to exercise an action independent of the organization, we acknowledge a further fact, which observation seems to stamp as a universal truth, that without the intervention of nervous matter no indication of psychical action has, or could, become manifest. This distinction between universal and particular truths must be carefully maintained in psychical investigations, as teaching that which is true of all must be true of many: that which is true of many may not be true of one; or, again, that which is only true of many cannot be true of all: the discrimination of each case depending on experience.

Regard the mind as a distinct existence and the body as a separate creation. There are many maladies of the spirit *in abstracto*, which it is the duty of the minister of religion to treat, as also many corporeal diseases, in which the mind is wholly and altogether free; experience tells us that the mind and body exercise a reciprocal reaction, when phenomena arise which one must be content to study through their operations. In philosophy we cannot always march forward straight to our objects. It is more frequently by examining the opinions of others, and observing the grounds and causes of the mistakes which they may have committed, that we are led eventually to the truth. In the study of mental diseases

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this is abundantly exemplified, for, even admitting the existence of originally independent units of mind and body, is there not that complete co-adaption of the two in the personality, which constitutes the natural or the normal condition of a particular individual? When this co-adaption becomes subsequently interrupted, antecedent to, or consequent on, the interruption of the unity must be either the imperfection of the units, or the intervention of a third cause, originating an abnormal condition when contrasted with that which had previously existed. Admit this third cause to be disease, manifesting itself in various phenomena, either those immediately tangible and referable to the physical organ of thought, or those evidenced through the secondary reactions of deficient or morbidly perverted functions; it becomes the object of the physician in either case to determine—

I. In a physical point of view, how far certain psychical manifestations are dependent on that abnormal condition termed disease.

II. In a psychical point of view, how far, in the absence of all physical manifestations, purely psychical phenomena are capable of receiving explanations.

Two questions here arise:

1. Can the existence of disease be always detected?

2. If with accuracy a certain pathological condition could be defined, would such afford sufficient ground to speak authoritatively of the influence it exercises?

In answer to the first: ordinary observation declares that the intensity of the disturbance of functions is by no means proportionate to the changes of structure in organs. For physiologists, it is difficult to believe that purely functional disorders can exist; each day discloses that inability to discover during life physical evidences of material changes is no proof that such changes are not present. The very existence of disease implies manifestations indicating organic derangement, while the best experience frequently fails to establish the presence of those changes, whose reality is at the same time inferred from the vital manifestations. Again, the sudden development of certain phenomena which have eventuated in death, has led to the discovery of such conditions as argued those phenomena to have been but the consummation of a silently progressive morbid process. In mental diseases the

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physician cannot altogether reject either theory, but must learn, as Goethe tells us, "to keep within the limits of the knowable;" and, like the architects of Laputa, who began to build their houses at the wrong end, be content to study many psychical phenomena as the known effects of variable and, in many instances, unknown causes.

Supposing, as Feuchtersleben writes, that "we are acquainted with all the chemico-organical and microscopical, as well as the physical polar process of the cortical substance of the brain during the formation or reproduction of a thought, have we thereby explained thinking?" To this it may be replied: No more than the minute chemico-microscopical examination of the hepatic structure has unveiled the ultimate mystery of the biliary secretion; or an accurate appreciation of the curative powers of a drug enables one to speak with confidence respecting each change in the vital alembic which follows on its administration. We may infer from this the response to the second query, and conclude that, though pathology and physiology fail to establish certain and fixed data, they do not fail to establish the most valuable relations, the study of which is the duty of the psychologist; while, in reference to the curative means so successfully employed, physicians are cheered in their labors by the assurance thus conveyed, that the actions of man, as his most holy duty and exalted task, may be performed without requiring certainty in all the problems of human knowledge.

When Sir William Ellis observes, and others re-echo the same sentiments—"I cannot think that any act, however vicious or eccentric, ought to be considered as the result of insanity, unless it be involuntary and arising from disease of the brain or nervous system"—they make a bold statement, and one which would pre-argue a capability of diagnosis independent of the evidence of disordered function, since scientists are not, in the present state of knowledge, at all in a position to speak with invariable confidence respecting the connection of appreciable cerebral disease with unsoundness of mind, further than the fact of their coincidence. Nor can they say such a lesion must of necessity be accompanied by particular phenomena; since varied lesions are accompanied by similar symptoms, and diverse symptoms seem to result from organic lesions in every appearance identical. Neither are they war-

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ranted in declaring an abnormal condition to be the cause of unusual vital manifestations, inasmuch as the researches of Andral, Dubois, and others tend to impress the belief that many of those pathological appearances may be as much an effect as a cause, having primarily a psychical origin; and, by the subsequent contingent extension of their physical alterations reacting on the nervous centres, and in turn giving rise to a new series of psychical manifestations.

The scientific treatment of mental disease leads to the study of the relations of the mind to the cerebral structure as the means through which its operations are manifested; to regard the brain as the organ of, not the seat of, thought; by reasoning on various pathological facts which experience has collected, to consider similar facts as so far important for the establishment of particular relations; and, at the same time, not to pre-argue an absence of those pathological conditions, because peculiar phenomena may not be sufficiently or prominently present. Was vitality uniform in its operations, disease should of necessity be a demonstrative science, and statistics propound a certainty in its recognition and treatment.

While there are two sources from which we derive data for our opinions, it appears that neither of them is sufficiently uniform to insure freedom from error. Nay, more, that this want of uniformity in their relations must be regarded as being, to a certain extent, a positive argument in depreciation of their separate value. It is right that it should be so. In allowing that physical signs cannot be always estimated by their symptoms, nor the importance of symptoms inferred from their physical signs, we but admit in psychopathy what is daily demonstrated in general pathology. How, then, is the physician to decide, except by the close study of the personality, and that individual application of the principles of psychical science which medical experience suggests?

It is known that for the explanation of many psychopathical phenomena the presence of physiological conditions can be adduced: we may example the morbid perversion of the senses and natural feelings, which during the period of utero-gestation is occasionally present. It is not to be presumed from this that such conditions are with all an excuse for criminal actions, though the fact be admitted that criminal acts have resulted from individual emotions identified with such conditions. Ever

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since Jacob "pelled" the rods of poplar and set them before the flocks, the mysterious and inexplicable sympathy between mind and matter has received startling illustrations. A shock occasioned by a mouse has impressed the fœtus with a hairy mole of corresponding shape and size. Extraction of a tooth has been followed by birth with cleft palate and harelip; denial of fruits led to marks on the infant, swelling and apparently ripening during their season; the meeting of repulsive deformities eventuated in their corresponding reproduction: these changes being accomplished at a period of utero-gestation that proves the shock to have been immediate, and the physical changes superinduced. Is there no teaching in this; when those in apparently sound health are thus influenced through mental agency? Is there not a converse to such action? May it not be assumed that some causes originating within the system, equally immediate in action, become manifest in psychical operations, such as an impulse to destroy? Who with any show of truth can hope to solve that mystery that either or both of these phenomena involve!

Again, witness the strange consequences which long-continued local irritation may occasion, giving rise to the varied hallucinations of the hypochondriac, and placing the individual at the mercy of merely local sensations. Who, however, from this is at liberty to presume that in all cases where anomalous pathological conditions exist, the person so affected can with impunity transgress established rules? That purely physical lesions are adequate to explain many psychical phenomena all enlightened physicians believe. "There are psychological mysteries which it lies within the power of pathology to elucidate, and which would, without its aid, remain obscure. There have frequently been witnessed deviations from the perfectly correct in conduct and amiable in manners, exhibitions of petulance of temper, and trespasses against the minor moralities, to account for which, upon a post-mortem examination, there have been discovered traces of painful, and, perhaps, previously unsuspected organic disease." What inference is to be drawn from this? That in every criminal case in which the plea of insanity is raised the existence of physical disease, especially if affecting the nervous centres, is of the greatest importance to be considered.

It is needless to repeat the many experiments which have

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been instituted, or the many cases recorded, in which, coincident with certain material changes or irritations, particular indications were so closely identified as to stand in the light of effects of known causes; neither would it be difficult to quote examples in which disease proceeded to a fatal termination without manifesting prominent symptoms, until such time as parts essential for the immediate purposes of the vitality became implicated. Drawing an analogy between the development of symptoms in physical, as contradistinguished from mental diseases, may it not fairly be inferred that which is true of one equally appertains to the other; and that psychical phenomena, as symptomatic of changes progressing in the nervous centres, may also remain in abeyance, until special circumstances develop their silent consummation, first prominently manifested in the perpetration of some criminal act? Every practical work abounds with illustrations of this double fact, all tending to place beyond question the necessity of remembering that though the *mens sana* may really or apparently co-exist with an admittedly disordered as well as a presumed healthy state of body, presumption must not be received as proof. Physicians are not warranted in asserting that because a mind may be apparently healthy, it is really so; or, if its operations be identical with those of disease, they are, therefore, the result of a morbid process—since many variations of conduct which in one individual must be regarded as undoubted evidence of a morbidly affected mind, irresponsible for its actions, may, in another, co-exist with and indicate a perfectly healthy state, arguing a full and undoubted possession of volition and reason: a fact which will be demonstrated when speaking of that form of mental derangement chiefly evidenced through unsoundness of the moral principle.

It is this anomaly which apparently justifies advocates, who seem to forget, and as often lead juries to do the same, that it is not in the abstract consideration, but the particular application and appreciation of principles the value of a special opinion rests. Counsel too frequently acquire their ideas of soundness or unsoundness of mind, as some do their notions of special affections, from nosological books which lay down their fixed descriptions of disease. Physicians may, on examination, admit the general truth of the one, and allow the ac-

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curacy of the other. Who is there, however, who has stood by the bedside of the sick, and seen the student of the closet, but has felt that the most important part of his knowledge was wanting, in the capability of applying the information he had acquired? The lawyer is this student of the closet! It would be quite as rational to expect that the jury, if guided by his opinion on the soundness or unsoundness of mind in a particular case, should place equal reliance on his advice respecting their individual states of health, from detailing to him certain symptoms, whose value as indications of various diseases nosological works have with equal confidence laid down. This is a proposition to which few would assent; for, in their own cases, they would ignore the competency of counsel to estimate the practical application of a science which they feel satisfied must be studied in the great volume of nature, written in works not words.

Willis writes: "To constitute derangement of the mind, his aberrations must be attended with bodily indisposition." If by "bodily indisposition" is to be presumed such a derangement of the general or special functions as may be evidenced to our examination, it may confidently be affirmed the assertion is at variance with experience; though, at the same time, we freely accord to the observation of Winslow: "We are too apt to form our estimate of character, without taking into consideration all those circumstances which are known to materially influence human thought and actions. The state of the organization and the health ought to be maturely weighed before we pronounce authoritatively as to the motives of individuals, or denounce them for not acting or thinking according to what our preconceived opinions have taught us to consider as orthodox." Cheyne, in one of his highly practical essays, declares, he has no doubt that "various immoral and vicious practices ought to be ascribed to insanity." The physician has a twofold problem to decide—the relation of crime to insanity—of insanity to disease.

What does the question of psychical responsibility imply? The self-mastery of the mind in its connection with the personality, in the same way as metaphysical freedom implies the self-mastery of the mind when viewed apart from the personality. It is only that psychical freedom which is identical with health, that, strictly speaking, comes within the prov-

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ince of the physician: The identification of motives with a mental condition, or the psycho-ethical relations of a particular act. Those causes which impede self-government and act morally, those faults and vices which society both promotes and punishes, constituting the ethico-legal considerations of the same act, come not within the physician's decision unless associated with this mental condition. If we admit his competency to decide on these latter, we permit as wide a range of opinion respecting each case as there may be difference in the sentiments of medical men. It is only when the diagnostic investigator discovers or presumes the existence of mental disease, for whose explanation the principles of medical science are alone adequate, that the physician should attempt to determine the incapability of being a responsible agent.

The question of unsoundness of mind in its relation to criminal acts is thus a compound or medico-legal one: Law may define the ethico-legal position as regards the act; medicine fix the psycho-ethical responsibility as regards the individual—a proposition we doubt not to fully establish, even though the greatest living jurist, Sir James FitzJames Stephen, has written: "To allow a physician to give evidence to show that a man who is legally responsible is not morally responsible, is admitting evidence which can have no other effect than to persuade juries to break the law." If the word "mentally" was substituted for "morally," would ground for the same observation exist: Is not the minor included in the major proposition?

From this a very important consideration arises. If physicians confess their inability from any one sign or combination of signs to speak confidently of the presence of disease, on what grounds do they argue to themselves superior fitness for psychopathic investigations? The evidence of "unsoundness of mind" is allowed to rest in deviations from that common standard of sanity which the general good sense has approved. Allowing the medical man to be competent to estimate the influence physical changes can exercise on psychical operations, is it in virtue of the presence of those physical changes alone his opinion is to be regarded as of value? The following cases arise. An act is committed corresponding in its immediate particulars to those ordinarily appertaining to crime: the plea of insanity is raised, and nothing but the act

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under consideration affords ground for such a plea, since on the closest examination the physician can detect no traces of physical disease, or other evidences of disordered nervous functions than such as are denoted by the consummation of the act. Again, an individual to all appearance in the enjoyment of perfect bodily health is found to be suffering from an affection presumably of the nervous centre, and is declared to be, and is, of unsound mind. To the ordinary observer both are as other men. The former develops congenital predisposition—the latter first indicates latent disease by the overt act—each constituting a subtle problem in mental disease.

Does not the question in these cases resolve itself into a simple proposition—the relation of a peculiar as contrasted with an ordinary mind? We admit as much, and reply, the elements in the formation of medical opinions are not thereby affected, since the suppósition that changes physically appreciable of necessity accompany insanity, is but an exemplification of a popular error, which confounds phenomena arising in with the cause of a disease; and, therefore, presumes their presence as essential in proof of its existence. The manifestation of those symptoms which originate doubt respecting sanity, may be the first sensible indication of functional disturbance; and the fact of their previous latency only be received as proof that they were not prominently developed, rather than that their morbid source did not exist.

Society is fully warranted in being jealous of her rights, and equally justified in seeking to prevent any body of professional men from assuming an authority in reference to matters affecting her interests, those matters being within her own control. Both the bar and the public are, however, deceived when they presume the general, not the particular, application of medical opinions. The question to be determined in psychical investigations is not whether certain phenomena indicate the soundness of the mind or morals of all men, but, how far they may enable physicians to estimate their relative condition in a particular individual. Were it otherwise, we should presuppose a uniformity in the mental constitution, which ordinary observation negatives. A physician is called on to declare his diagnosis; the value or nature of a certain indication is to be decided; does not his experience dictate a scrutiny; first, of the special symptoms which may

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be identified with this indication; second, of the general condition associated with these symptoms? Were he guided by the first alone, it is quite possible that in a single instance he might be right, but more than probable he would usually be wrong; did he depend wholly on the latter, the presumption is, he should be rarely correct.

Where, then, does the value of special or general indications rest? In their order of progression and combination, their association with each other, and their relation to the particular habit of life, and ordinary mental constitution of the individual. In mental disease the special symptoms are the manifestation associated with some particular act, the general symptoms finding their analogues in the ordinary mental operations. The previous history becomes as essential for the appreciation of the psychical as of the physical condition. But it may be said to the physician, "Those mental operations, constituting the history of the case, are open to the consideration of all, and if this be the basis of professional opinion, where is your right to claim any advantage?" The history of the case is one thing, the capability of medically reasoning on it another; and though we do not question the logic acumen of many wholly ignorant of medical matters, yet in consequence of this ignorance, their capability of reasoning is open to the objection that they must presume variable data as confirmed; whereas it is the establishment of the nature of those data which constitutes the essence of the inquiry.

If confirmation of this view were necessary, it is supplied by the observation of Lord Penzance.[5] In doubtful cases, "the physician can reason from the certainly to the probably diseased mind, and is enabled to trace in the latter lineaments which are clearly marked in the former. Thus while the world at large can only contrast the doubtful cases with the sane, the physician has at hand the alternative contrast with the insane. It is a consequence of these alternative methods of judgment, that the question of insanity, though it falls to the lot of a legal tribunal, is properly a mixed one—partly within the range of common observation, and is so far fit to be considered by a jury, partly within the range of special experience, and in so far the proper subject of medical inquiry. It is the office of the court, then, to inform itself, as far as

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opportunity permits, of the general results of medical observation, and to approach the subject on the two opposite sides thus indicated—searching for a fit conclusion by alternately presenting the parallel of sanity and insanity to the sayings and doings of the deceased."

Medicine is admitted to be a science of observation and analogy, in which experience declares that certain inferences may be drawn from the operation of different agents on organisms which nature has happily ordained should have a close similarity in each. Psychology, while being equally a science of observation, is even more so one of analogy; since the mental organism, being dependent almost wholly on external circumstances for its development, is as a consequence infinite in its variety. The standard of physical health of one is generally but a type of the same condition in many. The criteria of mental health, may, it is possible, be peculiar to the individual. Our physical constitution we admit to be influenced by a variety of circumstances over which we have no control, but whose power we can fully appreciate as more or less tending to modify the action of disease. Our mental constitution, it will be seen, while being identified with our physical, and as a consequence under the same influences, is capable of being acted on by circumstances altogether different in their nature. In our analysis of vital actions, as physically manifest, we recognize but the one undivided vital principle. In our analysis of mental vitality, as evidenced through psychical actions, we are presented with a duplicate operation of an integral power, evidenced in the intellectual as contradistinguished from the moral faculties; while, to increase the difficulty, those faculties, in many instances, seem to acquire an independent existence, since there are abundant proofs that not only may one be exercised irrespective of the other, or harmonize with the other, but it is even quite possible that in their separate operations they may, to all appearance, seem directly antagonistic.

If, in the diagnosis of physical disease the history of the case is regarded as essential for showing the order of development, combination, and progression of indications whose aggregation physicians are required to determine; how much more important is it, that in mental disorders all previous circumstances be not only fully investigated, but fairly estimated,

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for determining the influences they may have exercised on the several faculties.

It is known that in the physical organization, unless certain functions be duly performed, deviations from the admitted standard of health become sufficiently manifest to constitute disease. Mental operations present, however, innumerable deviations from the approved standard of sanity, and they cannot be received *per se* as evidence of disease for this reason, that the mental constitution having no fixed standard, the conclusions of two minds, admittedly healthy, may be diametrically opposed, and, owing to the capability of independent action which appears to be exercised by the moral and intellectual faculties, the actions of a sane and insane mind be perfectly identical, contradistinguishing moral crime from disease. Unless, in such investigations, the physician be habituated to question with accuracy and to reason with caution, he is open on all sides to an infinity of complications from which error may rise.

In physical diseases there are generally visible or tangible evidences by which to recognize change of the organism. In psychical affections we can have no means of estimating the character of any mind except through its operations. It is, therefore, essential, for all undertaking such investigations, that they be possessed not only of distinct criteria by which to define the mental health of the individual, but that they be also fully competent to estimate those various agencies, which, apart from physical influences, act or react on the particular mental constitution.

We have said "apart from physical influences," for we wish it not to be forgotten, that the physician is alone competent to speak authoritatively in cases where the immediate instrument of thought is involved. We have now, further, to contend that physical causes, altogether remote from the nervous centre, notwithstanding their apparent isolation, are still capable of powerfully influencing its operations, and in a measure modifying their character. Action and reaction are not only to be observed in mind as well as matter, but between mind and matter. It is a mystery involved in the very fact of our existence that such should be the case, since the closest investigation has resulted in no further discovery than that it is so. We are not competent to decide respecting the gov-

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ernment or direction of these interchanges of action, since the same apparent physical causes may coexist with perfect mental health in one, and in another be identified with, if not the cause of, a directly opposite condition. This fact it is which occasions their presence to be ignored by many who are incapable of duly estimating them.

Surely, it will be said, crime is not clothed in such deceptive robes, or sanity so enveloped in mystery, that fine-drawn subtleties are required for their exposition—Who would not know a villain, who could not recognize an insane? The supposed villain is, however, too often the insane, who finds in the guarding care of medicine his only sympathy or protection!

If it be contended that medical men are so pre-eminently adapted for such intricate investigations, and it be conceded that cases may arise in which the psychical estimate of crime involves many abstruse and difficult considerations, it may be asked, "Why are other than medical juries empanelled to adjudicate on such matters?" To this we reply: There are many grave and fitting reasons that the existing state of the law should be maintained. Were medical men required to primarily decide on the soundness or unsoundness of mind of an individual accused of crime; unless their opinions embraced the act originating the accusation, their adjudication would be altogether unjust; for that act might be the hinge on which their estimate of sanity should turn. If, on the other hand, they include the act, the onus of proof respecting the guilt or innocence of the party accused is thereby placed in their hands, and we have no grounds for inferring that, under such circumstances, greater unanimity would prevail than is seen in their evidence before the ordinary tribunals. Were they to assume the act as committed, they should thereby identify the question of the accused's sanity with that of his criminality. These, and many other reasons which might be adduced, lead to the belief that determining guilt or innocence by the voice of the jury, the soundness or unsoundness of mind by the opinion, after careful examination, of the physician, both subject to judicial criticism and direction, is the course best calculated to maintain public confidence and insure public safety—views we are glad to believe now acted on in the most important medico-legal investigations.

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We have not in the foregoing observations sought to deny the capability of a jury in many cases deciding from facts the presence of unsoundness of mind. In psychical as in physical diseases illustrations arise in which broad and distinct differences exist, denoting an unhealthy or altered condition. Common sense may as frequently pronounce the wit diseased, as the man without surgical knowledge diagnose the fractured limb. It is not to such examples our remarks apply. The public generally are unsuited, if not incompetent, to entertain many considerations psychopathic investigations entail. Even allowing they could divest their minds of natural prejudices, and with all honesty and earnestness seek by the most patient scrutiny grounds for their verdict, what does it amount to? The coincident opinion of intelligent men, who, it may be, decide an important question on the observation of an individual case, and thereby declare their capability of fully appreciating the various phases of a most intricate disease. Every mind has its own standard of mental and moral health, by which it is too apt to adjudicate on that of another. When men repudiate the conduct of another, they identify the feelings of that other with their own. They are conscious that certain deeds should with them indicate particular mental states, they therefore presume they can appreciate the same causes in another through their effects. In many particulars a diseased mind accords with their own—they, in consequence, refer the same capability to that mind. First starting with a proposition which they assume as correct, they then demand that you question not its truth; for, judging as they themselves feel, they decide as they judge. To those we would speak in the words of him who, though one of the greatest reasoners of any age, was not in virtue thereof devoid of error: "He that would not deceive himself ought to build his hypothesis on matter of fact, and make it out by sensible experience, and not presume on matter of fact because of his hypothesis."[6]

On most trials matters of fact and matters of opinion are submitted to a jury: the value of matters of fact may be open to the judgment of all—the value of matters of opinion must be proportionate to the capability possessed of forming that opinion. The question of unsoundness of mind in its relation to responsibility for a criminal act may rest on admitted mat-

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ters of fact, by which it is possible the jury may decide the issue; but, when those matters of fact come to be estimated in their presumed morbid relations, they are thereby converted into matters of medical opinion, when, as Hoffbauer has remarked, "the court should not hesitate to be guided by the same." When, therefore, we read such observations as have been attributed to the Lord Chancellor Truro and others, the former of whom is reported to have declared—"His experience taught him there were very few cases of insanity in which any good came from the examination of medical men. Their evidence sometimes adorned a case, and gave rise to very agreeable and interesting scientific discussions, but, after all, it had little or no weight with a jury;" we cannot, under such circumstances, regard the rejection of truth derived from experience as being other than tantamount to the adoption of error, and cease to wonder that even among the most able minds charlatanry should occasionally find acceptance. In the interests of humanity we are glad to record that judges of greater eminence have expressed far different opinions.

Justice demands that the grounds on which insanity be received as a plea for exculpation from punishment, or as a pretext for exclusion from social rights, should be as uniform as possible. We admit the difficulty of defining insanity; and yet, to recognize an insane person is a matter for which the majority of mankind believe themselves fully competent. We shall not attempt the former, but rather essay to offer suggestions which may at least tend to more fully demonstrate, and thereby, it is not impossible, diminish the obscurity of the latter.

It unhappily requires but little observation to perceive that crime and insanity have many features in common. The records of the one may be regarded as furnishing the most marked examples of the other. Although the illegal acts of the insane are ever far removed from that criminality with which they may appear as identical, it is, in many instances, no light undertaking to draw the line of demarcation, or to say what distinguishes iniquity from folly. We have repudiated the supposition that in psychical operations, similar manifestations must of necessity indicate uniformity of causation, and have affirmed that eclecticism is the only safeguard in psychopathic medicine. This will be exemplified in the study of cases to be subsequently detailed.

We may for the convenience of description state, that

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most, if not all, insane criminal acts are capable of being ranged under one of the following divisions.

I. Crimes against the state; II. Crimes against the person; III. Crimes against property.

The mental conditions which originate such acts are also reducible to a similar number of divisions:

I. Insane states manifested chiefly by delusion, or what has been termed "monomaniacal insanity," in which the intellectual or reasoning powers seem to be those more particularly involved.

II. Insane states in which the exaggeration or perversion of the moral intelligence or effective faculty is that most evident, constituting the "moral mania" of writers, when the intellectual powers are apparently unaffected.

III. Insane states in which neither the moral nor intellectual faculty is of necessity inadequate to appreciate the relations of a particular act, whose commission is alone explicable on the admission of an irresistible impulse—a form of disease described as "impulsive insanity."

In proposing such a division we seek not to establish any absolute connection between a special form of crime and a particular development of insanity, inasmuch as it will be evident that criminal acts capable of being ranged under one of these three divisions, or embracing the whole three, may find their plea of extenuation in either of these insane conditions.

In proceeding to the practical investigation of unsoundness of mind in its legal and medical considerations, we enter on a subject of general as well as special interest. Every psychopathic inquiry entails a deep and solemn responsibility: while we wish not to exaggerate, it would be equally unjust to speak lightly of its difficulties. Character, friends, and fortune, on such occasions, may be at stake. All are, therefore, particularly interested in establishing and upholding the most complete justice for the insane. Who is exempt from the visitation of disease? Confined to no class, identified with no position, peculiar to no country; old and young, rich and poor, learned and ignorant, our neighbor and the stranger, are alike within its reach. Protean in its shapes, insidious in its approach, direful in its effects, blighting its victim, and spreading desolation around, insanity, while isolating man from his fellows, appeals to their warmest sympathy, and at the same time honors medicine, by intrusting each wavering mind to her special care.

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CHAPTER II.

MONOMANIA.

MONOMANIA may be defined as a morbid mental condition induced and characterized by an habitual recurrence of similar thoughts which eventually concentrate in one fixed idea. In this disease the mind, as Reil well expresses it, "suffers a paralysis of its powers of conception," and is thereby rendered inadequate to appreciate the general or special relations of some particular point round which its thoughts, as it were, revolve. The causes conducing to this form of disease, though endless in their variety, present a certain uniformity in their results. It matters not whether the thoughts those causes engender be of a religious, political, or scientific nature; whether they have reference to the past, the present, or the future—the essential characteristic of the affection by them established is still preserved. The mind becomes morbidly impressed with certain suppositions, and is as a consequence rendered incapable of the healthy estimate of those relations to which such suppositions refer.

The study of monomania offers for consideration many of the most anomalous problems in psychology, since individuals whose minds are on some one point thoroughly deranged, may, as regards other matters, not only manifest extraordinary energy and acuteness, but also, while admitting the peculiarity of, defend their abnormal suppositions, with arguments requiring for their exercise considerable logical acumen. Fully competent to detect, they will even ridicule absurdities and peculiarities in others, which are trivial in comparison with those habitual to themselves; and thus, by the display of much intelligence and discrimination, frequently succeed in concealing the real condition of their own minds; rendering it in such cases difficult to conceive why a capability for the disposition of property, or responsibility for acts other than acts arising from the delusions, should not appertain to those so

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afflicted. Such cases constitute the crucial tests of psychical science.

Psychical and physical diseases for their estimate present a perpetual contrast. The greater difficulty experienced in the diagnosis of the former may be ascribed to this contrast. In the physical constitution of men a certain uniformity of structure is visible, any departure from which is immediately appreciable: corporeal actions being regulated by recognized vital laws, the criterion of physical health rests in the harmonious adaptation of the one to the other; when this becomes interrupted, proportionate to the importance in the economy of the function impaired, is the disturbance which ensues; in the mental constitution the same facility of recognizing abnormal conditions by no means exists, since the standard of mental health cannot be equally well defined. Abstractly considered, the evidences of mental disease in one person may be identical with the healthy and ordinary exercises of another, as a consequence of which, for their differential diagnosis much difficulty and doubt in such instances is experienced. It becomes, therefore, a matter of serious importance, when cases arise in which the existence of insanity is based on arguments explicable by the dictates of reason, that society be preserved from the danger which might result from the too easy reception of such a plea; while, at the same time, humanity be exculpated from responsibility for those sad operations of disease which, it is possible, may eventuate in the natural disposition to crime being more prominently, because morbidly, developed. In obscure physical disease, the keystone of diagnosis is the history of the case; yet, with all the evidences and aids which modern medicine can bring to bear for its elucidation, how often must caution regulate opinions, while prudence temporizes treatment. In mental disease, and in this particular form above all others, unusual difficulties demand increased care for their exposition. In many judicial-psychical questions the physician must, as Kant observes, "call the philosopher to his aid," since not only does it behoove him to estimate the psycho-ethical relations of certain mental manifestations, but also to determine the relation of those manifestations to the personality. What does this require? Not a hasty visit, not the mere listening to a simple recital of apparently anomalous facts, not such a melancholy display as has been witnessed on

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some trials, where medical men without experience in insanity, and with but imperfect opportunities for observation of the case under adjudication, have volunteered their evidence: but —that deliberate investigation, indicating anxious experience, which scrutinizes the individual character, the progress, order, and combination of symptoms, their relations to the psychical and physical constitution, and gives as the result of their conjoined evidence a definite and matured judgment. Certainty in knowledge is not permitted to man; the most we can, therefore, hope to accomplish is, to limit fallibility within narrow bounds. In psychical as in physical disease this is sufficiently evident; since, while admitting that every concession to crime may be regarded as an exaction from justice, cases will arise in which the conflicting evidence adduced renders it a merit to doubt, though the humane spirit of our legislature affords to the individual accused of the most flagrant crime the benefit of that doubt. It has been observed that the standard of mental cannot be equally well defined as the standard of physical health. There are many facts which strengthen this opinion; they rest on ordinary observation of life. Coleridge truly wrote: "Society would be broken up, and man would loathe his brother man, if the secrets of each heart were laid open to public gaze." This affirmation must be conceded. As we write not to depict the follies of the day, and are not of those who consider a knowledge of human nature to signify an acquaintance with the mere vices of mankind—though it is true that such information is essential for a just estimate of humanity—we shall not pause to give extracts from a book in which each one may read; yet, on the analysis of the heterogeneous mass of which society is composed, we cease to be surprised that many are found content to acquiesce in the sentiments of others, be they monomaniacal or otherwise, rather than to reason for themselves; to manifest a sensibility in their detection of trivial faults, and an equal incapacity for their recognition of great merits; to show in their estimate of one class of offences temerity and fastidiousness, which contrast strangely with their appreciation of another; to exaggerate the importance of knowledge scarcely available; and to undervalue, if not deny, the existence of those peculiarities which proclaim their own inconsistency.

The complex nature of the question under investigation

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renders it essential to fully appreciate the various sources from which the elements of a just psychopathical opinion are derivable. These may be enumerated as follows:

I. Study of the general and special relations of the individual affected.

II. Analysis of his mental and moral constitution in their mutual reactions.

III. The relation of the monomaniacal conception to the foregoing.

Society has imposed certain observances and rules to regulate and direct the association of its members. The necessity for such is at once apparent on consideration of that want of uniformity in the intellectual and moral constitution of man which is on all sides visible. The basis of these regulations may be regarded as resting equally on the ethical as well as the psychical perceptions of men—their object being the social assimilation of one to the other; their end, the establishment of order and preservation of good-will. Public opinion, that is, the aggregate expression of individual sentiment, has therefore at all times been a legitimate object of honorable ambition. Its disregard indicates a desire to establish an independent standard of excellence, which seldom fails to bring its moral penalty in the forfeiture of that confidence essential for the enjoyment of the proper mind. It is not by this meant to imply that men are to pander to the follies, acquiesce in the weakness, or comply with the absurdities, fashion may require —far from it! These are too often but the gaudy toys with which conventionality seeks to divert the judgment of sober reason. We have little hesitation in declaring that those obligations of society which good sense has dictated, and experience approved, as promoting individual comfort by maintaining among its members mutual respect, cannot be altogether despised; without leading us to question the stability of the intellect, as well as the purity of the morals, of those who have the hardihood to so act.

Society demands conformity to her established rules, and is jealous of each innovation in her code. Not but alterations are being continually introduced, fashions changing with the season, manners with the age. The universal judgment of men recognizes, in the compliance with those usages they may have approved, a definite and known state of mind re-

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specting which they are adequate to form an opinion, and accordingly presume on their capability of appreciating the relation the same state of mind should have to circumstances which they are not so competent to estimate. From the coincidence of action in one position we identify the animus of another with our own, and are, consequently, apt to refer their several actions to the test of our individual consciousness; and, being satisfied that, under similar circumstances, the performance of a particular act would be entirely contrary to our feelings or disposition, we cannot, therefore, account for their occurrence on any reasonable principle, and seek to explain the difficulty by assuming derangement of either the moral or intellectual faculty.

Sir William Ellis observes: "In a state of sanity the various feelings and propensities are kept under control, partly by their mutual influence upon each other, partly from moral causes, and partly from the restraints imposed by society. When careful education and religous feeling have rendered their due regulation habitual, strong propensities may exist unknown and unsuspected except by the individual." This preservative influence of society is exercised in many ways, not the least important of which being the habit of self-control it engenders. "Habit," it has been well observed, "is second nature." Dugald Stewart, in reference to custom, writes: "It is one of those natural instincts which no reasoning or process of thought is able to either produce or to prevent." Habitual self-control affords, next to religion, the surest guarantee for mental and moral health, since temptations successfully resisted in the end become powerless, while vice with each succeeding indulgence acquires additional force, until at length the "still small voice" of conscience ceases altogether to be heard.

Goethe, in speaking of society, observes: "Nothing brings us nearer to insanity than distinguishing ourselves above others; and nothing preserves the even tenor of the understanding so well as a general intercourse with many people." Thus it is that society contains within itself resources for its own protection: were it not so, ambition would be wholly without regulation, and the mind, in subjection to its innumerable impulses or passions, proportionately suffer. In society is chiefly to be found the reaction of one mind on another, the

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beneficial effects felt to be derived from congeniality of sentiment, which insensibly influences if it does not wholly determine our associations; together with that mutual encouragement and assistance, which enable the intellect to bear up against the most gigantic exertions. Whether in the extended field of politics, or the narrower sphere of professional life, it is this mutual co-operation and reaction which accomplish great events either for governments or science, and preserve at the same time the standard of excellence with the equilibrium of sense. It may be observed, that when men undergo a similar amount of mental toil, being isolated from their fellows and wanting this insensible regulation, their minds are, under such circumstances, prone to suffer accordingly; when either some one idea acquires a mastery which, uninterrupted, becomes so deeply rooted as to influence their whole subsequent career — actual monomania resulting; or, the thoughts in their continual reaction revert on themselves, when but trivial circumstances are required to develop some special indication of a more general insanity.

A physiological observation of men has established a fact of importance to be remembered. Certain psycho-physical differences appertain to some individuals, which enable them to apprehend the exterior world in a manner peculiar to themselves alone, and to react on it. It would be easy to enumerate examples of special physical constitutional peculiarities or idiosyncrasies in many, which not only co-exist with the enjoyment of sound health, but whose very interruption indicates the presence of disease. Observation proves an analogous condition to as frequently exist in the psychical constitution, when it becomes a matter of the very greatest importance to distinguish those peculiarities and idiosyncrasies of feeling and thought which specially appertain to particular individuals, from similar conditions of feeling and thought which may in others be most valuable as denoting the presence of disease. In the majority of instances it needs but little ability to recognize that which, for want of a better name, is termed eccentricity. A single interview is often sufficient to establish the opinion that much individual peculiarity exists; it would, however, be shallow philosophy and dangerous practice to regard such as indicative of unsoundness of mind. We do not believe that any experienced physician would do so,

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since it is the continued observation of successive phenomena in the same individual which enables him to arrive at their true appreciation. A particular act, or succession of acts, to acquire value as a symptom of insanity, must do so through the fact of its denoting a departure from the natural and healthy character, temper, or habits. It is not, therefore, sufficient that the medical man who would determine the question of soundness or unsoundness of mind be informed of special acts which he contrasts with what he may regard as an approved standard of mental health, but it is requisite that his standard be the admitted mental health of the individual, that the acts specified may have their value determined accordingly; since, to quote the words of Dr. Gooch, "it is the prolonged departure, without adequate external cause, from the state of feeling and modes of thinking usual to the individual in health, that is the true feature of disorder in mind." Ordinary observation is sufficient to confirm that it is the relative appreciation of an act which determines its value. What is our test of sanity? Are we of the school of Chrysippus, "which deems every man mad whom vicious folly or the ignorance of any truth drives blindly forward?" Is the departure from a fixed rule, or the acquiescence in established usages, one way or another, to determine our opinion? Both of these questions invite to discussion. Folly and ignorance must ever be distinguished from crime and iniquity, to which, however they may predispose, they are not of necessity allied: originality of thought must not be confounded with that which, in its ordinary signification, we term "singularity," since its manifestation may be the most convincing evidence of superior intelligence. It cannot be denied that in all countries where intellectual activity has been awakened, one of the most powerful agents in the wise direction of human events is the tendency of original thought to differ from general opinion; when, living, as it were, in advance of their age, master minds have disregarded those narrow bounds within which routinism would restrain the most splendid genius. Universally it will be found that the greatest triumphs of the human mind have been accomplished in direct opposition to the current of general opinion, and that public thought in one age is not infrequently but the echo of solitary meditation in that which had preceded it. If proof be required of this, we

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have but to look to the social as well as scientific revolutions which have within the last few years been perfected; or, to regard those many mighty undertakings which, throughout the civilized world, are at this moment being carried out. The doubt as to what may be accomplished, and the detail of what has been effected, place the same question in a very different light. At no period should scepticism be more thoroughly in abeyance than at the present, when the very elements are subservient to the will, and the wish but the prelude to the act. No proposition must therefore be rejected because it is new. How many men have foreshadowed truth while propagating supposed errors which enveloped and developed the most profound discoveries of their succeeding age?

There are innumerable examples of mental gifts, or congenital endowments, which place certain men in immeasurable advance of their fellows. Their intermediate stage of education and development appears to be passed in a bound. At an age in which study and observation can have had but a small part, examples of extraordinary capacity are found above and beyond their associates, who have been subjected to the same guidance and influence. In science and art, phenomenal genius possessing intuitive experience has enriched mankind by discovery or astounded by performance. The world is the wiser and the wealthier for such. By what standard are they to be judged? From the days of Galileo to this our time, theory and experiment in philosophy and science have brought the so-called "mysteries of nature" within the range of exposition or demonstration. The common knowledge of to-day would have been regarded as visionary and its illustrations as miraculous by the philosophers of former times. Are we wiser men, or only wiser in our generation? Who will attempt to define onward progress, or say when its limits will be reached?

It may not be inappropriate to here briefly review the past so far as it bears on the subject under consideration. A phase of mental disturbance, as evidenced in public credulity, has within the last thirty years become more particularly developed. "Spiritualism" has had crowds of converts: professors of its art and mystery thriving on the ignorant susceptibilities of the multitude, to the great disquiet of weak-minded believers in the supernatural. The action and reaction

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of psychic-force evoking nervous sympathies in excitable temperaments, has, in many, produced hysterical-cataleptic results appreciable by the physician, but to the uninformed full of mystery, as so-called "mesmerism" revealed susceptibilities but little understood by the ordinary observer. "Animal-magnetism" has illustrated the controlling power of one mind over another and the subordinate action of the physical to the mental constitution, which to the ordinary observer seems inexplicable; "clairvoyance," in which Providence is believed to impart a power of divination, either to some member of the great unwashed, or to a more pretentious "medium," for the purpose of exhibition to the multitude at one shilling a head, or a higher scale according to means, has had its believing followers; "planchette," through its involuntary writing establishing communications with the absent or the dead; "table-rapping," with its code of interpretation, have both found willing dupes to bow down and worship at the shrine of charlatanry, offering in some instances as evidence of their belief all their worldly possessions. These things done openly, from their effrontery and publicity have been suffered to go unchallenged, in the hope that common sense would prevail. There has happily been one exception known as the "Huddersfield Spiritual Case,"[7] where the professor was convicted as a rogue and a vagabond, and sentenced to three months' imprisonment with hard labor, for doing that which men of light and leading had hesitated to denounce as proceedings deserving of ridicule and contempt. An appeal to the Superior Courts has placed on record the judicial decision. Francis Ward Monk, in his attempted flight from justice, left behind him his instruments of trade, gloved models of the human hand, elastic tapes and wires, phosphorus, and other accessories. It is to be hoped on the termination of his term he was a wiser if not a better man. An illustration scarcely less ludicrous occupied our Equity Courts. Mrs. Lyon, a wealthy widow aged seventy-five, found in Home, a spiritualist, one worthy of her adoption as a son. Home had placed her in direct communication with "her dear husband," who, from the other world, informed her he was "happy, happy, happy," and added that he "loved Daniel (*i.e.*, Home) as a son, and he was to be her son." In compliance with the direction so conveyed, and further wishes similarly expressed, Home was

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adopted and endowed with many thousands of pounds conveyed by deed. Business called him from the widow's side. During his absence, jealous expectants improved the occasion. A rival medium was introduced, the dear deceased, less happy, through the new intervention denounced Home as an "imposter," and in a mundane spirit, unworthy of Paradise but nevertheless practical, advised proceedings at law. This advice was also followed. By the decree of the court the money was ordered to be restored, and to the credit of Home, who had it under his absolute control, let it be recorded that such was done. The public was informed of the views of the judge, Vice-Chancellor Gifford, who thus spoke: "I know nothing of what is call 'Spiritualism' otherwise than from the evidence before me, nor would it be right that I should advert to it except as portrayed by that evidence. It is not for me to conjecture what may or may not be the effect of a peculiar nervous organization, or how far that effect may be communicated to others, or how far some things may appear to some minds as supernatural realities which to ordinary minds and senses are not real. But as regards the manifestations and communications referred to in this cause, I have to observe, in the first place, that they were brought about by some means or other, after and in consequence of the defendant's presence, how, there is no proof to show. In the next, that they tended to give the defendant influence over the plaintiff as well as pecuniary benefit. In the next, that the system as presented by the evidence is mischievous nonsense, well calculated on the one hand to delude the vain, the weak, the foolish, the superstitious, and on the other, to assist the project of the needy and adventurous; and lastly, that beyond all doubt there is plain law enough to forbid and prevent the retention of acquisitions such as these by any 'medium,' whether with or without a strange gift, and that this should be so is of public concern, and, to use the words of Lord Hardwicke, 'of the highest public utility.'"[8] This judgment proved social death to such exhibitions. They ceased to be fashionable, and were accordingly denounced. Home became the guest of foreign courts, where he continued to find favor in the eyes of many. These are but two instances in which the veil of imposition was rent and frauds of no mean character exposed, and yet "the great spiritualist" had, and

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continued to have, numerous influential patrons and friends, who lent willing aid to that they wished to believe, accepting as truths the subtle outpourings of self-constituted speculators in mysterious revelations, for the better trading on the superstitious weakness of mankind and the deceiving of many.

It is scarcely necessary in a work professing to treat unsoundness of mind as a scientific question to affirm that crucial tests, within the comprehension of the most ordinary capacity, have been applied to clairvoyance, spiritualism, and similar conditions alleged to endow with exceptional powers, without in one single instance a satisfactory result for those interested in the frauds. "Thought-reading," the most recent of exhibitions, is omitted from the foregoing as puerile and harmless for an evening entertainment.

It is much to be regretted that these pernicious teachings have not been limited to the more humorous impositions on the public in dark or open séances, in sounding instruments or floating figures, or the less mysterious demonstrations of burly scoundrels tightly corded, who within a press are unbound by spirits. The same doctrines have found expression in a sensual religionism to which property and purity are alike subordinated, and the principles of free love preached and adopted. The case of Nottage v. Prince[9] (Bridgewater Agapemone) illustrates how far that hysterical exaltation of mind to which women are so often liable can be utilized by saintly adventurers for their own benefit. It is not, however, necessary to rely on so recent a decision or to quote the judgment of Vice-Chancellor Stuart in 1860, in order to express the judicial opinion which happily prevailed respecting "men whose canting and whose doctrines have no other tendency than to plunge their deluded victims into the very abyss of bigotry, despair, and enthusiasm. Men who go about, in the apostle's language, and creep into people's dwellings, deluding weak women. Men who go about and diffuse their rant and enthusiastic notions to the destruction, not only of the temporal concerns of many subjects of this realm, but to the endangerment of their eternal welfare. And shall it be said that this court cannot relieve against the glaring imposition of these men? that it cannot relieve the weak and unwary, especially when the impositions are exercised on those of the weaker sex?" These are the words of Lord Chancellor

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Northington in the case of Norton v. Relly,[10] decided in 1764. They leave no opening for addition or amendment.

It would seem that belief in the supernatural changes but its form of credence. Witches yesterday—mediums to-day. As recently as the early years of the present century witchcraft had its numerous believers. The Mosaic law, "Let not a witch live," was cited as proof of their existence. Sir William Blackstone writes: "To deny the possibility, nay, the actual existence of witchcraft and sorcery, is at once flatly to contradict the revealed Word of God in various passages of the Old and New Testament, and the thing itself is a truth of which every nation in the world hath in its turn borne testimony either by example, seemingly well attested, or by prohibitory laws, which at least suppose the possibility of a commerce with evil spirits." Sir Matthew Hale, in a trial of witches at Suffolk in 1665, stated in the course of his summing up to the jury, "that there were such creatures as witches, he made no doubt at all." Pope Innocent VIII., in 1480, had issued a bull for "the discovery and burning of witches." In the fifteenth century there seems to have been a wholesale massacre of those who were believed to hold communication with the powers of darkness. Especially so was this manifest on the continent of Europe. In the year 1515, 500 witches were burnt at Geneva in three months. In 1525, 1,000 were burnt in the diocese of Como and 100 per annum for several years. From 1580–95, 900 were burnt in Lorraine. England took a more moderate part in such atrocities, and yet they were no greater than those that, in the name of religion, had been inflicted by professing Christians one upon the other who differed in matters of doctrine. So great did the public interest continue in the witch question that James the Sixth of Scotland, in 1597, published a work on "Dæmonology," and, writing no doubt his royal experience and research, thus proceeds: "Witches are not generally melancholic, but some are rich and worldly wise, some are fat and corpulent, and most part are given over to the pleasures of the flesh; and further experience daily proves how loath they are to confess without torture which witnessethe their guiltinesse." The royal reasoning and inference are worthy of the subject, and are no doubt as reliable as his Majesty's description, which is most disquieting, for if witches still be, one must be cautious how they join pleasant company.

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Knowing that ridicule is no argument, it is yet difficult to treat these questions with the seriousness they deserve. The huckstering of supernatural revelations for small coin, or accrediting relations with Satan to visionary fanatics who make market of ignorance and superstition, is too absurd to discuss. Facts, however, must be accepted as the proof and record of the times. It is to be hoped that witchcraft and its kindred manifestations have with the Cock Lane ghost become matters of tradition, and that the next public craze will appeal to the higher rather than the weaker sensibilities of humanity. There is much teaching in this retrospect. As late as the year 1800 supposed witches were in England subjected to the "ordeal." In 1785 a woman in Northampton was swum for a witch, her thumbs and great toes being tied together: to the ordinary sense such a process would appear not favorable to natation. She fortunately escaped. In 1759 Susannah Hannokes was in church, regarded as the public court for the trial, in the presence of her accuser and an assembled crowd, weighed against a Bible, and being the heavier escaped with her life. These incidents of the past are sad to read, and yet great and gifted men then lived and ruled the councils of the nation. What test or definition of delusion should have been applied to them? Or were they but wise according to the light that was in them? light on such matters but sufficient to make darkness visible. ("Side-Lights of the Stuarts," by F. A. Inderwick, Q.C., has a chapter on witchcraft which exhausts the learning on the subject. To it the author of this work is much indebted.)

These illustrations may be regarded as but so many social occurrences, which, however indicative of ignorance or weakness, leave untouched the great question of insanity in its graver personal relations. They offer much matter for reflection when asked to regard men either as sane or as irresponsible because of the apparently absurd belief or opinions they either entertain or express.

Occasions arise when the nicer points of diagnosis which distinguish credulity and superstition from mental unsoundness are of the first importance, especially so when dealing with the social status of those mentally afflicted. It is important to note the principle regulating lunatics in their civil as distinguished from their criminal relations. The former

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have associations and associates which demand equal considerations with the sufferer. Sir William Grant, M.R., held:[11] "A Court of Equity will not interfere to set aside a contract overreached by a commission in lunacy, if fair and without notice, especially where the parties cannot be reinstated." This judgment has since prevailed. Nor is lunacy an answer to wrong-doing in other actions, except the wrong complained of is incident to and part of the lunacy. Again, it was fully argued before the House of Lords in Mordaunt's case (a divorce appeal), the judges being in attendance, and determined that "though a respondent be of unsound mind and unable to plead, divorce might be asked for and decreed on behalf of or against a lunatic, the court appointing a guardian *ad litem* for protection." In this case it was conceded that the allegations in the petition referred to a period antecedent to the supervention of mental incapacity, and that the respondent, at time for pleading, was of unsound mind. It was argued that divorce was a quasi-criminal proceeding, the defence of which might be presumed to mainly rest on the evidence of the respondent. Lord Hatherley, expressing the opinions of the majority of the law lords and judges, declared "by the law of England, adultery, though a grievous sin, is not a crime, and the analogies and precedents of criminal law have no authority in the Divorce Court—a civil tribunal." Further adding, "in the proceedings against a criminal every step is arrested by his or her becoming a lunatic, but the proceedings in divorce is not a criminal proceeding." The views of Sir Henry Keating and Sir Lionel Brett, that "proceedings may be instituted but not continued against a lunatic after the lunacy has been duly found, and that a lunatic cannot be a petitioner for a dissolution of his or her marriage," being opposed by Sir Fitzroy Kelly, C.B., supported by the majority of the judges, on the ground of personal right, expediency, and public policy. Which judgment prevailed as against the technical exposition of Clauses of Divorce Act affecting the respondent, and the powers therein given to plead and tender evidence, in favor of which the minority had expressed strong opinions.

On most criminal trials many simple, logical, or ethical propositions are put forward, and the jury thus become, as it were, personally identified with the replies of the medical witness, whose value they estimate according as they may

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correspond with or differ from their several sentiments; whereas the matter to be determined is not, Does the presence or absence of particular manifestations indicate the soundness or unsoundness of the mind or morals of all or of most men? but, How far the presence of these special manifestations indicates the mental or moral condition of the particular man? If we admit the general application of such a question, we should premise a certain and fixed standard of mind, and an inquiry would arise respecting the mental soundness of any two men entertaining opinions diametrically opposed. Bacon rejected the theory of Galileo with scorn: who would impugn the sanity or wisdom of either? The more limited application of the proposition leads to the special examination of each case, when, as in the diagnosis of physical disease, the application of general principles by no means implies the adoption of a general rule. Had we but a moral intelligence, no doubt respecting our opinion could arise, for our moral standard is fixed, and does not, therefore, admit of being disputed. Every vicious man should then be considered insane, as acting against the first law of nature in consummating his eternal destruction. The difference between right and wrong admitting under such circumstances of no dispute, insanity and vice should be identical; that is, supposing that, in the absence of a reasoning process, either was possible, which we by no means admit, inasmuch as our movements, wanting the elective power of the intelligence, would be purely instinctive. The compound nature of our mental organism, however, disarranges this simplicity. The moral is at fault —the intellectual extenuates; the intellectual errs—the moral puts forward some excuse; so that men at length, in self-defence, are required to adjudicate on the excesses or deficiencies of either intelligence, as vice or insanity. The safety of society demands that a difference be maintained between crime and insanity, and the safety of the individual requires that the relation between any particular crime and his state of mind be established. Insanity may be stated to be a diseased condition in which the mental harmony is disturbed, and the intelligence as a whole is unable to appreciate the relations of an act. Crime, on the other hand, may be regarded as the evidence of, so far, an analogous condition, the mental co-operation is perverted though maintained, and the

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capacity for appreciation remains. On what does the will of man depend? Is it not the ultimate decision which the moral and intellectual faculties conjointly determine? Lord Hale was not wholly wrong when he declared "all crime to be the result of a partial insanity;" for if the will be the product of mental operations, and those mental operations be opposed to the rule of right which the intelligence has acknowledged, that mind cannot be regarded as a sound mind which, thus imperfectly or improperly, arrives at a decision. We are brought to the question: Where does the ability to determine on a particular case cease or commence? for accordingly must be the responsibility or irresponsibility of the offender. Experience and observation prove that this mental guidance is, to a certain extent, under a man's own control; it follows that those illegal acts resulting from such a deficient or defective regulation of the mind as is within the individual direction of the will, are justly regarded as crimes; while similar acts, originating from mental conditions beyond the control of the will, cannot be esteemed as other than so many evidences of insanity. "No one," writes Dr. Duncan, "I presume, will dispute that every man who commits a crime or indulges in vicious habits acts as if he were mad—that is, he does not duly and correctly compare and weigh the consequences of his present actions, for if he did he would undoubtedly abandon them. The difference between the two cases is this: while the man in full possession of his faculties shuts his eyes to results that he does not choose to see, the poor lunatic, being blinded by his infirmity, is incapable of looking in that particular direction, and is, consequently, not acting against the impulses of his natural judgment." Consequent on the want of uniformity in the psychical and ethical perceptions of men, it follows that in many instances so much of crime as belongs to insanity is unnoticed, and so much of insanity as accompanies crime is undetected, until from some overt act an inquiry is instituted into their connection. The identification of crime with such a condition of mind as this is one proposition; the identification of crime with insanity, in its general acceptation, is altogether another; by confounding the two much injury to man and injustice to society must result, for the lunatic might be thus punished as the criminal and the criminal escape free.

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The question comes to be discussed, What are those criteria by which may be determined the distinction between that condition of mind where man ceases to be a free agent and that in which responsibility is maintained? Knowing the difference of original mental constitution, circumstances, habits, education, and other modifying causes which conspire to produce a diversity of character and disposition in each, we are warranted in asserting that much of the doubt and difficulty in forming or receiving opinions has arisen from futile attempts to generalize on this particular point. Experience strengthens our belief that it is but presumption to propound a general rule. Winslow well writes: "No single fact nor any accumulation of facts, for each of which a possible, though inadequate, reason may be assigned, is *per se* conclusive of irrationality." Further observations more fully establish this truth and also indicate the danger of being guided by the opinion of those who, judging from the mere concurrence of events, because there may be a coincidence of phenomena which denote health, therefore presume that disease cannot be present. As we proceed in psychical analysis and become conscious of the moral and intellectual differences observable in men similarly circumstanced, exposed to the same temptations, and having equal means for the gratification of their wishes, the conclusion will force itself on the mind—despite of all that Locke and others have written to the contrary—that "there are certain intuitive principles appertaining to each individual, which, independent of education, give a natural bias, and sometimes a premature development to certain faculties." Therefore it is that an estimate of an individual character is the balance by which the value of symptoms presumed as indicative of unsoundness of mind in that individual must be determined.

The most limited observation cannot fail to supply many examples to which the ordinary criteria of sanity can scarcely be said to apply. Habits of deep thought and of abstruse research, in many minds, more fully develop personal peculiarities, which demark certain men from their fellows; such may, it is possible, transgress, or rather neglect, many of those conventionalities society requires, and revel in the luxury of their peculiarities. Their moral exculpation is, notwithstanding, generally conceded, while their individuality is

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excused for the sake of that genius it envelops. When the moral intelligence becomes similarly involved, the offender is, however, placed in a far different position. Abstraction of mind must be distinguished from abandonment of principle; thoughts preoccupied be regarded as distinct from morals depraved; lest actions which are odd, but innocent, be confounded with conduct outrageous and evil. In pursuing a psychical study of the general and special relations of the individual presumed as being mentally affected, it becomes of vital importance to draw the diagnosis between an inability and an indifference for perceptions—an originally defective mental constitution, and that which succeeds to vicious indulgence—a deficient conception of moral responsibility and a wilful abandonment of moral rule. The experienced physician, if opportunity be afforded—and without this he should ever be silent—may generally succeed in truly estimating those peculiarities which distinguish eccentricity from insanity. The one must be regarded as the result of a sound judgment, unduly, indifferently, or perhaps erroneously exercised; the other arises from an inability of the judgment to act properly: the one offending against regulations established by custom—the other acting in opposition to those rules dictated by reason: the one, though in some instances not admitting of explanations wholly satisfactory, yet offering nothing in extenuation which is opposed to sense; the other capable of adducing no motive that does not involve an absurdity: the one acting according to a judgment based on principles resulting from his own rational, though, it may be, erroneous or perverted conceptions—the other acting according to fancies based on premises which admit of no recognition.

The elucidation of the question we are immediately discussing does not demand the same close analysis of the mental or moral intelligence in their mutual relation as an investigation into the subject of moral insanity entails; we rest satisfied with declaring that in the human mind two principles are recognizable, an intellectual and a moral, which, though capable of distinct exercises, are for the ordinary purposes of life intimate in their association and harmonious in their co-operation. For the fulfilment of positive duties it is evident that the direction of a discriminating judgment becomes es-

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sential: the moral estimate of those duties being involved in the just appreciation of their relations. Regarding such a dependency as conceded, we proceed to the more practical exposition of monomania in its relations to crime.

Sir John Nicholl's opinion, in the case of Dew v. Clarke, makes insanity consist in the existence of delusion. Lord Erskine's views may be also quoted as propounding the same doctrine. Sir J. Nicholl has defined delusion as "a belief of facts which no rational person would have believed." Well may it be asked in the words of Sir J. P. Wilde, "What are the limits of a rational man's belief?" Lord Brougham has amended this definition, and stated delusion to be "a belief of things as realities which exist only in the imagination of the patient," pointing out that Sir John Nicholl gives a consequence o' a condition as its definition. Delusion is again defined as "a pertinacious adherence to some delusive idea in opposition to plain evidence of its falsity." On this it may be observed, "Evidence of falsity is to be plain." Who is to say if it be so or not? Will all sane men agree whether evidence is plain or not? Again, the definition fails as including in its subject-matter a delusive idea in argument explanatory of itself. It is admitted that the fact of an opinion being altogether different from those ordinarily held, does not, therefore, constitute it a delusion. That which is quite clear to one mind may be wholly inexplicable to another. An opinion which is the result of deep reflection and sound inference may, to those incapable of estimating the premises or inductions, appear as the offspring of a deluded imagination or an overwrought fancy. The mere circumstance of an opinion being contrary to sound sense is no argument of unsoundness of mind in the person entertaining it, for an uneducated man may draw many inferences which are opposed to the simplest dictates of experience.

No one is surprised that an ignorant man should propound doctrines at variance with the admitted results of science; though we are ready to declare that similar doctrines, if advanced by another, might with truth be regarded as indicating his irrationality. We cannot regard the most decided change in the longest-cherished opinions as in itself indicating unsoundness of mind: since this change may result from that greater capability of forming a judgment which increased

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experience or more matured reflection affords. "Though it may be an unsatisfactory reflection, it is yet a wise one, to consider our existing convictions as liable to error, like those which have preceded them." We are not at liberty to argue the irrationality of men who accord to sentiments which our better-regulated reason may abhor or our scriptural faith condemn, inasmuch as they may, for the entertaining of those sentiments, find such matter to form the basis of their faith as harmonizes with the unenlightened condition of their minds, though our intelligence altogether rejects the same as being opposed to every principle of right. In our estimate of the several delusions presented by the insane, we must therefore be ever careful to establish and maintain the distinction between erroneous conclusions from facts submitted to the intelligence and just conclusions from suppositions which originate in the intelligence. A man in the first position may entertain notions altogether at variance with those commonly received, and be at the same time, in the psychical and legal signification of the term, sane; while those in the second position may be influenced by the most dangerous sentiments, which, it is possible, escape detection until such time as some circumstance arises adequate to interrupt the ordinary latency of their course, and, as a consequence, to occasion their more prominent development. The mere diagnosis of monomania, irrespective of its association with crime, is surrounded by no ordinary difficulties.

How often has it occurred that death-bearing disease has silently progressed to such an extent as rendered its detection but the prelude to its close. The physical constitution possesses such a power of vital accommodation as enables it to tolerate any abnormal condition which does not, of necessity, interrupt its functional exercises. Post-mortem examinations have revealed important alterations of structure which, it may be, were never once suspected, or whose nature had at least never been determined. In psychical affections an analogy is fully sustained. That a man may be competent to conduct the ordinary affairs of life with credit to himself and advantage to others, that he may be adequate to fill high and important offices, and in the natural course of events leave this world without a question respecting his sanity or a blemish on his name, while during the greater part of his life

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he was under the most absurd delusion, which was not detected simply because special circumstances did not lead to its prominent or unusual manifestation—is a fact which Dr. Duncan's experience and that of others has established.[12] In the instance mentioned, the evidence of the deranged intelligence rested on conceptions requiring for their exposition inducements altogether different from those met with in the ordinary affairs of life, and were therefore held, as it were, in abeyance, because circumstances calculated to develop the animus influencing the conduct did not prominently present themselves. This capacity for self-control or prolonged abeyance of the active influences of insanity has, in civil actions especially, led to much learned discussion as regards so-called "lucid intervals." In Waring v. Waring it is laid down: "By a lucid interval is not meant a concealment of delusions, but their total absence; their non-existence in all circumstances, a recovery from the disease and subsequent relapse." The marginal note puts the proposition even higher: "To constitute a lucid interval, the party must freely and voluntarily, and without any design at the time of pretending sanity and freedom from delusion, confess his delusion." It may be presumed that the "confession" is the test of the non-existence. On such an assumption this judicial ruling has, so far, been wisely permitted to rest in abeyance, since in the large majority of cases it would be found impracticable as a test, and when practical unreliable. Recent authority, it will be shown, has set aside this ruling, and has done so for reasons that are conclusive. In the year 1843 an inquisition was held before Mr. Commissioner Winslow upon a young gentleman of fortune and of mild manners, whose insane propensity was connected with windmills. When being removed by his friends to a place where there were no mills, in the hope that the strange propensity would wear away, the youth formed the resolution to commit murder, in order that his residence might be thereby changed, which act he accomplished on the body of a child whom he induced to accompany him into a wood. Lord Erskine,[13] in the course of his defence of Hadfield, observed that he remembered a man who indicted another for imprisoning him, and no act of the counsel (Erskine himself) could draw from him an indication of disordered mind; but when Dr. Sims appeared in court the man addressed him as

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the Lord and Saviour of mankind. On account of this extravagance the person indicted by him was acquitted; but the man persevered, brought another indictment, and well remembering what had caused the former to fail, could not on this second occasion be brought to say a syllable indicative of his mental delusion. The existence of a delusion does not imply a capability of detecting it, while its most prominent manifestation may in no wise accord to the character of the crime it originates. Crime is naturally supposed to be the offspring of motives of one kind or another. When insanity is advanced as a plea in its extenuation, it must be by explanation of the act through reason of the motives, and the exculpation of the motives on the grounds of the delusive conceptions. Accordingly, many very eminent authorities have argued the necessity of establishing the relation between the delusion and the act, and made it the test of mental incapacity. In some cases a capability of doing so exists; if such were possible in all, much anxiety would be spared those involved in their adjudication. The instances detailed and others we shall enumerate prove that it is not in the nature of insanity as a disease that such uniformity should exist.

In defending Hadfield for shooting at the king, Lord Erskine argued that "to exempt from responsibility there must be a close connection between the delusion and the act." Were this acted on, how few lunatics tried for murder would escape, how many should fall victims to our incompetency to form just judgments! Hadfield apparently shot at the king with the view of being capitally punished for it. In the hope of insuring his condemnation at a time that he was perfectly conscious of right and wrong as regards the act, William Ross Touchett, brother to Lord Audley, fired at Thomas Smith with intent to kill, but was acquitted on the evidence of Dr. Monro. In both these cases there existed an insane desire for death, accompanied by the fear of committing suicide. Many similar examples might be adduced. Under such circumstances, to regard the acts of the insane as those of a healthy mind would be to enable the lunatic to accomplish his wildest determinations.

"Nullum magnum ingenium sine dementiâ" is an aphorism which is far more true than is generally supposed. The peculiarities and more than eccentricities of many famous men

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prove them to have been under delusions of one kind or another; and the fact that they did not become criminal may be as much owing to the want of such an exciting cause as might so divert the current of their thought, as to any capability they possessed of successfully resisting incentives rather than inducements to crime. It is not by this assertion meant to insinuate that any necessary connection exists between genius and insanity. True genius is, if not based on sound sense, generally associated with it. The fact, however, remains incontrovertible, that many distinguished for the highest intellectual efforts have in their persons exemplified the slight barriers which separate exaltation of mind from alienation. If we inquire into the cause of this, special and general reasons present themselves; the first having reference to that undue receptivity and extraordinary excitability such minds too frequently exhibit—the second being assignable to the nature of the mental as well as physical occupations which usually appertain to such individuals. It is one thing when the intelligence can so command the imagination that ideal worlds rest within the control of the will. It is another and far different position when the imagination triumphs over the intelligence and acquires thereby the mastery of the will. In the one, the mind acts on the external world, and can withdraw from the contemplation of its ideal conceptions, or at least subdue them to the practical exercises of life. In the other, each motive to action results from impressions having no real foundation, and is, therefore, liable to vary with or according to, the character of such impressions. "Imagination," writes Sir Walter Scott, "renders many liable to be victims of occasional low spirits, when, but for the dictates of religion or the natural recoil of the mind from the idea of dissolution, they are willing to throw away life as a child does a broken toy." "People," observes Lord Byron, "analyze the supposed causes of maladies of the mind; and if the sufferer be rich, well born, well-looking, and clever in any way, they conclude he or she can have no cause for unhappiness; nay, assign the cleverness which is often the source of unhappiness as among the adventitious gifts that increase, or ought to increase, felicity, and pity not the unhappiness they cannot understand." "The irritability of genius," continues the same author, "is nothing more or less than a delicacy of organiza-

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tion, which gives a susceptibility to impressions to which coarser minds are never subject, and cultivation and refinement but increase it, until the unhappy victim becomes a prey to mental hypochondriasis." "The master mind of Johnson in early life was overwhelmed with a horrible hypochondria, with perpetual irritation, fretfulness, and impatience, and with a dejection, gloom, and despair which made existence misery." The gift of a beautiful mind was, as Tuckerman remarks in the case of Cowper, marred by an unhappy temperament—"the chords of a tender heart proved too delicate for the winds of life, and the unfortunate youth became an intellectual hypochondriac." We might extend this list; and, particularizing the rashness of Chatterton, the failings of Collins, the aspirations and early death of White, the disappointments of Hayden, and the unhappiness of many others, inquire, "Is this the fault of themselves, or of nature in tempering them of too fine a clay, or of the world, 'the spurner of living and patron of dead merit?'" The purport of our present investigation does not call for such a scrutiny.

The instances quoted are sufficient to show that individuals of such a class open to us a new page in the psychical history of man, in which the pleasures and pains, joys and sorrows of life are strangely commingled, and for the appreciation of which ordinary criteria prove inadequate.

In the psychical estimate of such characters unusual difficulties must, therefore, always be expected. A certain license is both claimed and granted, for notwithstanding the apparent anomalies in their dispositions, much matter-of-fact ability and practical intelligence may also be manifest. Dr. Rush writes of a judge and of a divine, both confessedly insane, but whose discriminating judgment on the bench and whose refined eloquence in the pulpit were admirable. Baron Swedenborg, who was adequate to perform the duties of his office as minister to the king of Sweden, was so mad as to pull off his hat and make obeisance to Moses or Elijah in a crowded street, and fancied that the twelve apostles sat by him on twelve chairs in his apartment. A gentleman of high standing, under circumstances of unusual excitement, manifested unequivocal evidence of insanity, for which he was obliged to retire from the bar and to reside within a private lunatic asylum —proceeded on two different occasions from the asylum to

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attend county assizes, where, in virtue of an office he held, he was intrusted by the crown with the conduct of most important prosecutions affecting life and liberty: which duty he sufficiently discharged, although his state of mind rendered it requisite that immediately after the termination of the assizes he should return to the asylum. We might particularize many other examples proving that delusions of the most extravagant character may occupy the mind, and yet the individual be fully competent for the dispassionate consideration of the most intricate questions, not involving the subject-matter of the delusion. Could we insure the non-extension of such a particular state of thought, we might, with perfect safety, allow those thus affected to be at large, to manage their properties, and take part in the ordinary affairs of life. But does experience tell us we can do so? Because many who labor under certain delusions do not commit crime, can we therefore declare that others who are influenced by similar delusions are responsible for their conduct? Can we take upon ourselves to determine the secret workings of the intelligence, and affirm that a particular act is the result of the deliberate judgment uninfluenced by considerations which we know to exist, and which we admit are adequate to materially affect, if not to wholly subvert, that judgment?

It has been laid down, "the only delusions which prove insanity are insane delusions." Sir J. P. Wilde asks, "But what is to be said of the more complicated cases? What if the diseased action of the mind does not exhibit itself on the surface, as it were, opposing its hallucination to the common sense or reason of all mankind, but can be tracked only in the recesses of abstract thought or religious speculation, regions in which the mental action of the same produces no common result and all is question and conflict? In what form of words could a 'delusion' be defined which would be a positive test of insanity in such cases as these?"[14] To affirm that insane delusions prove insanity is to be equally wise with Polonius—

> "To define true madness,
> What is it, but to be nothing else but mad!"

Lord Brougham's observations in his adjudication on the will of Sarah Gibson, the subject-matter in Waring v. Waring,[15] are explicit and deserving of careful study:

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"If the being or essence which we term the mind is unsound on one subject, provided that unsoundness is at all times existing on that subject, it is only sound in appearance; for if the subject of the delusion be presented to it, the unsoundness of mind, as manifested by believing in the suggestions of fancy as if they were realities, would break out; consequently it is absurd to speak of this as a really sound mind —a mind sound when the subject of the delusion is not presented—as it would be to say that a person had not the gout because his attention being diverted from the pain by some other powerful sensation, he for the moment was unconscious of his visitation. It follows from hence that no confidence can be placed in the acts, or in any act, of a diseased mind, however apparently rational that act may appear to be or may in reality be."

This doctrine remained unchallenged for many years. On criminal trials it afforded counsel powerful arguments. In civil actions, especially in probate cases where delusion had existed, it was relied upon as proof of testamentary incapacity. In Smith v. Tebbett [16] Lord Penzance accepted and acted on its ruling. It was reserved for the judges in the case of Banks v. Goodfellow [17] to evince a higher knowledge of psychology, and, having carefully considered the two previous cases, to declare, "they were cases of general, not of partial insanity, and the doctrine therefore embraced in the judgment was wholly unnecessary to the particular decisions, and this being so, the question was not concluded by authority." Before proceeding to deliver judgment Lord Chief Justice Cockburn entered on a most valuable *résumé* of the opinions of eminent authorities on the question of delusion, and observed: "M. Troplong, in his well-known work, 'Le Droit Civil expliqué,' [18] and M. Sacase, in a treatise entitled 'La Folie considérée dans ses rapports avec la Capacité Civile,' [19] have adopted the doctrine of the unity and inidivisibility of the mind, and the consequent unsoundness of the whole if insane delusions anywhere exist. Writers equally entitled to respect have maintained the contrary view. Le Grand du Saulle, in a very able work entitled 'La Folié devant les tribunaux,' [20] contends that 'hallucinations are not a sufficient obstacle to the power of making a will if they have exercised no influence on the conduct of the testator, have not altered his natural

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affections, or prevented the fulfilment of his social and domestic duties; while, on the other hand, the will of a person affected by insane delusion ought not to be admitted if he has disinherited his family without cause, or looked on his relations as enemies, or accused them of seeking to poison him, or the like. In all such cases where the delusion exercises a fatal influence on the acts of the person affected, the condition of the testamentary power fails: the will of the party is no longer under the guidance of reason, it becomes the creature of the insane delusion.' M. Demolombe, in his great work, the 'Cours de Code Napoléon,'[21] M. Castlenau, in his treatise 'Sur l'Interdiction des Aliénés,' and Hoffbauer, in his remarkable work on 'Medical Jurisprudence' relating to insanity, have maintained the doctrine of monomania, or partial insanity, not affecting the testamentary disposition, does not take away the testamentary capacity. Mazzoni, in a recent work, entitled 'Istituzioni di diritto Civile Italiano,'[22] lays it down that 'Monomania is not an unsoundness of mind which absolutely and necessarily takes away testamentary capacity, as the monomaniac may have the perfect exercise of his faculties in respect of all subjects beyond the sphere of the partial derangement.'" Having cleared the ground by quoting these authorities, his lordship, in an elaborate judgment expressing the opinion of the full court, ruled: "Where the delusion must be taken neither to have had any influence on the provisions of the will nor to have been capable of having any, such delusion did not destroy the capability to make the will, and that a will under such circumstances should be upheld." Which judgment may be accepted as the present judicial mind on that question.

This is a practical acceptance of and dealing with facts and a common-sense view of this intricate question. If men move in and are of the world, mixing in its affairs in the mutual confidence of enterprise, any other doctrine would lead to endless complications, or estop many from the active business of life. Those who dissent from the views expressed in the judgment that assumes as adequate for the directing a will the same self-control as was manifested in other serious matters, have at least the assurance that for the real purposes of life, when the question arises and is discussed in the form therein expressed, substantial justice is done at least to

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the written intentions of the deceased; intentions which during life he was permitted to act upon. The term "nor to have been capable of having any" must be interpreted to imply—as far as human judgment can infer from the actions of the deceased. Human judgment directs judicial decisions.

We have intimated our dissent from opinions which, irrespective of the existence of a delusion, identify responsibility with the knowledge of right and wrong as regards the act committed. In the case of Martin, tried for burning York Cathedral, it appears that he was fully conscious of the criminality of the act as regards its relation to the human law, but said "he had the command of God to do it." In those cases previously detailed the acts were known to be contrary to the law of both God and man, since it was such knowledge led to their commission, through the anticipation of the punishment which should ensue.

The physician who has had opportunities of studying monomaniacal disease must have remarked that many of the delusions entertained are sometimes slight perversions of a natural process of reasoning, and that in numerous instances "trifles light as air" lead to the commission of crime. Events which, under ordinary circumstances, would be regarded as of little consequence, if they harmonize, with the delusion, become a source of morbid excitement to the monomaniac, since his mind is predisposed to their reception. Opposed to this, real calamities which suddenly occur, more especially if they be not consonant with the pre-existing delusion, by withdrawing the mind from the ideal contemplation, have not infrequently been productive of the greatest benefit to the disease. The effect is far different when such are but superadded to previously existing and similar anxiety or care, for under such circumstances the powers of the mind may be broken down by the various overwhelming influences, and one of the predisposing causes of the insanity become the proximate cause of the crime. This was manifested on the trial of John Ovenston, at the Central Criminal Court, October 27th, 1847, indicted for feloniously shooting George Crawley with intent to kill. In this case it appeared that George Crawley, who survived the wound, had been instrumental in having the prisoner's goods sold under a judge's order, and that the prisoner in the afternoon of the same day attempted his assassination.

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On the evidence of Dr. Conolly it was proved that the mind of the prisoner had been gradually losing its power, from the difficulties by which he felt himself surrounded, and that the crisis had arrived when he committed the act; and he (Dr. Conolly) "did not consider that his being at the time of trial, or soon after the transaction, in a state of perfect sanity, in any way affected the opinion he had formed, or was at all inconsistent with that view of the question." Here we have the predisposing cause of the insane state—pecuniary difficulties—identified with the person of an individual (Crawley), and this individual becoming the proximate cause of the crime. This is as instructive a case as is on record, for there was no prominent delusion, Crawley being the true occasion of the immediate distress. There was the existence of explicable motives on the part of the accused—revenge on the admitted cause of his distress; proof of premeditation in going armed to the office where the occurrence took place; evidence of self-control and discrimination which enabled the prisoner to withhold his violence until a fitting opportunity offered to effect it; the testimony of the medical attendant of the jail, Mr. M'Murdo, who "never observed anything to lead him to believe that he was of unsound mind;" while, added to this, the statements of other intelligent witnesses were adduced, who affirmed that on those matters respecting which they were competent to form a judgment, the prisoner seemed equally sane as themselves. Yet, with this accordance of facts and such corroborative testimony, one of the most experienced as well as distinguished psychologists of any age—Dr. Conolly—declared that "he did not go the length of saying that the prisoner was unconscious of what he did, but he believed that he was acting under such an impulse as he could not control, and that he could not distinguish the wickedness of the act, although he was conscious that he was committing it." This impulse must have been the result of a morbid conception identified with the person of Crawley, for otherwise, to use the words of Mr. Baron Rolfe in the case of Charles Burton, indicted for the wilful murder of his wife and child, "the excuse of an irresistible impulse, coexisting with the full possession of reason, would justify any crime whatever."[28] To this latter case, tried at Norfolk circuit before Mr. Baron Parke, July 20th, 1848, that of Ovenston was closely analogous, for in

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both the attempt at crime and its commission were suggested by a fact, not a delusion; both in their previous symptoms showed equal grounds for presuming the presence of disease; both after the commission of the crime attempted suicide; while as regards the crime itself, there was this important difference, that on Ovenston's trial it was shown there were reasonable grounds for attributing the act to rational though vicious motives; while in Burton's case there was a perfect want of evidence to prove that any motives could have existed, since there was no known cause of disagreement between the man and his wife. The medical evidence in both was in favor of insanity, yet one was acquitted and the other found guilty and sentenced to death, though subsequently admitted to be insane.

Mr. Baron Alderson's opinion, when addressing the jury on the trial of Robert Pate, may be here quoted: "In the first place, they must clearly understand that it was not because a man was insane that he was unpunishable; and he must say that upon this point there was generally a very grievous delusion in the minds of medical men. The only insanity which excused a man for his acts was that species of delusion which conduced to and drove him to commit the act alleged against him. They ought to have proof of a formed disease of the mind—a disease existing before the act was committed, and which made the accused incapable of knowing at the time he did the act that it was a wrong act for him to do." This is in principle an anticipation of the ruling in Banks v. Goodfellow, as applied to the commission of crime. The former involved life—the latter property. The one required delusion to be identified with and influence an act in order to excuse the accused from its commission, the other, because the delusion was not associated with or influenced the bequest, upheld the testator in its execution. Such opinions are of the highest value as far as they extend, but beyond their reach arise complications and combinations which strain to the uttermost the disciplined judgment of the bench in their direction to juries, on whom devolves the duty of seeing that the public or individual safety is not lightly sacrificed, nor subtle theories too hastily adopted; since it is impossible with legal precision to define how far insane men are responsible; associate in all cases delusion with insane criminal acts;

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diagnose in each instance the mind disordered previous to the consummation of the disease; identify the knowledge of right and wrong with the capability of voluntary action; or, in other words, lay down a rule which may fix to a standard the variable nature of disease, and reduce to a special scale the mysterious working of Providence.

The advocate-general, in the case of Henrietta Cornier and M. Dupin, on the trial of Darzac, has declared that monomania "is a chimera, a mere phantom, summoned as much for the purpose of snatching the guilty from the just severity of the law as of depriving a citizen arbitrarily of his liberty."[24] M. Collard de Martigny also asserts that "monomania is nothing but a passion which might be stifled in its birth." Let us inquire into the truth of these opinions.

Mill has observed there are two sources whence knowledge may be derived: the direct and the inferential. The first involves the immediate exercise of our senses; the second implies a capability of comparison, and, therefore, presupposes a criterion for judgment. In our diagnosis of psychical as of physical disease, it is essential that the information derivable from each of these sources be fully sought out, in order that, through their relations, their separate value may be estimated. The mere presence of a certain physical sign may, it is true, present the most unmistakable evidence of a special condition which is so plain and tangible that all recognize its nature. In psychical disease analogous phenomena can be with equal facility appreciated. How often, however, does it occur that the presence of a physical condition rests for its determination, not so much on its individual physical indications as on their relations to other general indications which are at the same time present. In psychical disease the analogy is fully maintained; owing, however, to its immaterial manifestation, a much closer investigation and a more intimate analysis are required; for not only must the essential nature of the indications be separately defined in their special and general relation to each other, but their accordance to the individual character be also determined, before an opinion be offered on their importance as characteristics of vice or disease; which, as Kollar well affirms, should be ever most carefully distinguished. The psychical as the physical constitution must be regarded as the ultimate expression of many

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operations which, in their normal perfection, preserve a certain unity indicating health. When in physical disease this unity is interrupted, the patient is himself not only fully conscious of such a fact, but generally presents definite indications of the same. Defective or diseased functional exercises proclaim their operations in language which cannot be misunderstood. Men are conscious of this in their own persons, and consequently, while those indications characteristic of health are preserved in another, do not readily credit the existence of disease, however energetically its presence be affirmed. In psychical affections there are numerous additional reasons why this unwillingness to believe and inability to discriminate should invest the consideration of many cases with extreme difficulty. Effects, not causes, are the chief elements in our opinion. We infer the latter through the former, and estimate the former from their relation to a variable standard. The evidence of disease in one may be identical with the exercises of health in another. When, therefore, the plea of monomania is adduced as extenuation for crime, there is often nothing more difficult than to believe that acts which accord in their progress to the ordinary routine of natural events are the result of a morbid condition of thought, and we do not, consequently, wonder that many are to be found disposed to doubt the possibility of such being the case.

To deny the presence of such a disease as monomania entails the proof of its existence, which is invested with this difficulty—its evidences may rest on symptoms which, though perfectly explicable to the mind of the investigator, are altogether different in their relations to that mind of whose nature they are the chief indications. The error most usual to those who have not studied criminality in its psychical associations is this: Its evidences are estimated, not in reference to the mind of the individual accused, but to an admitted or presumed standard of mind. Ordinary observers draw their inferences according to the power or influence of their own motives as compared with their own position, rather than by their estimate of the motives which might actuate others in a far different position to commit the same act. We seek not by this to argue that the distinctions between vice and virtue require for their establishment fine-drawn subtleties or abstruse calculations; but we affirm that, because the practice

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of either may co-exist with the perfect exercise of reason, such affords no just ground for inferring their identification with any particular mental state. Experience confirms this, since the monomaniac may be distinguished for moral excellence and the criminal be altogether free from the slightest taint of disease. How, then, is the fact of unsoundness of mind to be determined, if we admit that similar symptoms are met with in mental conditions so different? It by no means follows that because the same elements exist in separate bodies, those bodies are identical, or that in our estimate of vital actions a similarity of symptoms is confirmatory of a uniformity of disease. The value of symptoms rests on the order of their appearance, progress, and combination. In psychical affections this is abundantly manifest, and in none more so than in that of monomania whose existence has been thus questioned.

Monomania might be well considered as a disease in which the mind appears to suffer from "a paralysis of its powers of conception," and is inadequate to appreciate the general or special relations which the subject-matter of the monomaniacal conceptions involves. In the most healthy mind there is nothing more difficult than to unlearn—that is, to divest the mind of preconceived notions, in its abstract consideration of any matter involving the simple logical relations of these notions: and why? To do so requires an original and vigorous effort of thought, and the independent operation of an intelligence already preoccupied, which, on the particular matter to be investigated, is in the most imminent danger of being abnormally or deficiently exercised. The mind in which a monomaniacal predisposition has been established has each of its natural tendencies exaggerated, and therefore it is that, with a process of reasoning insanity, a patient so affected is at times not only singularly pertinacious in the defence of his absurdities, but is also enabled, as in the case quoted by Lord Erskine, to baffle such inquiries as might be instituted into his mental condition.

There is, to diminish the difficulty in diagnosis, a remarkable and close analogy between the progress of crime and that of monomania. This assertion may appear paradoxical, since the analogy might be presumed to have a contrary effect: why it is so will be apparent.

Most criminal acts may be regarded as the ultimate oper-

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ation of vicious habits, in which the infringement of the civil law is superadded to the habitual disregard of each ethical relation. Under these circumstances the nature of the act to be considered manifests such conformity to the previous character, that no one questions the operations of justice or hesitates to believe in the full criminality of the offender. The mental process by which a delusion becomes established, and the stages of vice preceding the perpetration of crime, are equally progressive. The first crime, like the first monomaniacal supposition, the moral as well as mental intelligence may repudiate; fresh inducements to crime occur; the moral sense may yield to the temptation, yet be conscious of the fault, in the same manner as the mind of the monomaniac recurs to the supposition it *in initio* admits to be unsustainable. Temptation successfully resisted loses its power—temptation when yielded to increases in strength. Thus step by step and stage by stage a certain condition becomes established, be it monomania or crime. In the commencement of the first, it is quite possible that whatever the nature of the monomaniacal tendency be, its relations are estimated according to the dictates of sound reason, and the delusive conception dismissed as soon as formed. A period of mental freedom elapses; thoughts of the same character recur; circumstances may conspire to confirm them; with every confirmation the opinion they tend to is strengthened, and with the strengthening of the opinion the intelligence is rendered, so far, less disposed to question its accuracy. In the progress of crime a similar progressive movement is observable, "*nemo repente fuit turpissimus*" being most true. It is by acquiescence in vicious practices aptitude for crime becomes established, when the moral intelligence, failing to enforce its dictates, ceases to respond to the perception of right.

A certain similarity in the nature of the progress of this form of metal disease and vice is thus maintained. As crime entails a breach of some regulation appreciable by the general perception of man, and usually affecting their immediate interests, its discovery is seldom a matter of difficulty; but inasmuch as the evidences of monomania not infrequently accord to the natural mental exercises, its diagnosis, it is possible, may be most obscure. Juries are therefore fully justified, while the law allows them the privilege of pronouncing judg-

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ment respecting such matters, to hesitate in delivering an opinion; since in examining their own hearts they may find much to correspond with motives or conduct of whose nature they are, under the most solemn obligation, called upon to determine. "How few," as Dr. Conolly so truly remarks, "can sincerely say that in themselves no foibles or imperfections, no passions or heedless impulse, no sins, presumptuous or conceded, exist; which, in certain circumstances, might not have led to sorrow, or never-ending regret or despair. to crime or to shame." [25]

Were mankind originally endowed with similar mental or moral constitutions, it would, notwithstanding such a conformation, be but reasonable to expect that the variety of agents acting on that constitution would produce an equal difference in their results; and that, therefore, as individuals progressed to maturity, the multiplicity of pursuits which occupy and the diversity of interests which influence each would so develop different mental or moral faculties that this original identity should thereby be lost. It appears, however, from our observation of life, that this mental difference observable among us is not the mere work of accident, but pre-ordained for the greater perfection of the great whole, of which we each constitute but so many items. Did men all think and act alike—did the same tastes uniformly prevail, it would be easy to imagine what our social condition would be, with requirements little more than instinctive, and pursuits as a consequence scarcely in advance of the animal. Deeply implanted in each breast is the onward impetus. To it all that is great in science or useful in art is due. Men's interests are reciprocal and their dependency is mutual; because, however their dispositions or habits vary, their ultimate object—individual enjoyment while here—is the same; their ultimate end—future happiness hereafter—identical.

As each one has his pleasures, which, however they be reciprocated, none can so truly realize as himself, so each one has his sorrows that are known but to himself. "The trials of life are like countries—every one has his own, and to attempt to reduce them to one common type would be to set aside the peculiar sensibility proper to each." [26] Admitting this diversity, it must still be remembered that there are certain ties, feelings, and affections common to all, the mainte-

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nance of whose harmony involves the social happiness of each. Divine law ordains that our natural emotions be held in regulation; human justice demands that their injurious exercise be punished, unless it be proved that the individual was, at the time, irresponsible. This is, we contend, the great question for the physician, the more so when we reflect how much of misery and how much of crime do men voluntarily create for themselves. Many are to be met with who willingly abandon themselves to particular habits, and live in disregard of ordinary rules. Society may be indifferent to the sentiments of the one and tolerate the peculiarities of the other. Each one claims his right of private judgment and independent action, and it is conceded to each; but for mutual regulation a certain conformity of the will to the law is required, since a spirit of duty and power is thereby secured; for were men permitted to conform the laws to their will, with the difference of the will there would be a difference of the law, and an end to anything like uniformity on earth. Peculiarity of opinion is one thing; peculiarity of conduct is another. The law seeks not to recognize any peculiarity of opinion as being identified with irresponsibility, until this peculiarity, of whatsoever nature it be, becomes associated with such conduct as proves the individual to be so completely under the influence of that opinion that his actions are incapable of being regulated by other motives than those which that opinion may supply, in consequence of which his own well-being or that of society is at stake and in danger.

We have impressed the necessity of fully analyzing the individual character and inquiring into the previous history before attempting a diagnosis in mental disease. Circumstances will occur in which the fullest knowledge of both affords little guidance in the formation of opinions, beyond the negative proofs they may offer of a special disposition. Many men are found to be laboring under a delusion, whose previous conduct has not demonstrated the process by which that delusion has been established. Many individuals are undoubtedly guilty of the most flagrant crimes, whose previous life was strangely at variance with the execution of the particular act. Knowing the passions, the desires, the motives, which influence the minds of men; the deceptions practised by those who assume virtues which they do not possess—we are

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led to the conclusion that, though every moral observance is an important reality, yet the absence of crime is no guarantee for the presence of virtue; nay, more, that the exercise or practice of mere moral observances cannot be received as conclusive evidence of the existence of a high moral sense. Men may cherish feelings of malignity against some one of their fellows, which, in accordance to the opinions of others, they endeavor to subdue. Criminal desires may influence the conduct, which is manifest in the exercise of practical benevolence with tho

> "Who thus do clothe their naked villainy
> With old odd ends, stolen forth of holy writ,
> And seem as saints when most they play the devil."

In men of this class hypocrisy envelops rascality until such a time as fitting circumstances unfold their true character. These circumstances may not arise until the opportunity occurs for the perpetration of a particular act, and then, when society demands the investigation of that act, a confident appeal is made to the previous career to prove, not the non-existence, but the concealment, of criminal desires. It is true that in such an instance the commission of crime may argue that the passions so far overcame the judgment as to render it incapable of estimating the relations or calculating the consequences which might result from the perpetration of the act, of whatsover nature it be, and the excitement of the moment create "*furor brevis*," and so, to a certain degree, extenuate its commission. This is the most that justice can concede, for did such excitement excuse the crime, the majority of capital offenders would be acquitted. The actions rather than motives must constitute the test of criminality. The individual application of this test rests on the opinion of the jury on the one hand, and the diagnosis of the physician on the other, who in such an instance are called on to discriminate between crime and disease, and to say how far one may have been influenced by the other.

In seeking to establish the relations between monomania and crime, it would be a grievous error to suppose that all monomaniacs must be criminal. The indulgence of particular whims may be indicative of folly of the most extreme degree, which does not become crime until such time as, for the ulti-

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mate gratification of a peculiar fancy, of whatsover nature it be, the axioms of morality and of law are wilfully violated. Letting it be remembered that morality and law are not identical, instances are on record in which, for the possession of matters not within their reach, thefts have been perpetrated by individuals in whom insatiable desires of one kind or another existed. The illegality as well as abstract immorality of the peculation may be fully admitted, but the capability of resisting temptation be wanting, even though in all other respects the strictest observance of propriety and the nicest sense of honor be maintained. Monomania may in such individuals lead to actions which their intellectual and moral animus condemns, and a difficult question arise as to how far such individuals are responsible; for though the intelligence may be weak, it does not follow that it must be wicked. It is in the fact of moral deficiency coincident with intellectual sanity that criminality rests. This mental inability to direct the moral intelligence originates a proposition as to how far both, in such an instance, or in similar instances, may or must be associated.

The subject of monomania is one so extensive and important that to enter minutely into a detail of the peculiarity of its manifestations, the complexity of its symptoms, and the variety of its terminations, would necessitate a comprehensive analysis of mental operations, and a close investigation of the correlation of the psychical and physical constitution, as evidenced in an almost endless variety of cases. It would be vain to hope to do more here than state those principles which should guide in instituting so serious an inquiry.

A criminal act is attributable to a monomaniacal condition. The cases which may have eventuated in this condition come to be investigated, and are found capable of being ranged under the following heads:

I. Causes apparently appreciable by ordinary observers: the insane act corresponding to the usual operations of crime.

II. Causes explicable solely by the psychopathic condition of the individual: the inducement to the insane act originating in the deranged intelligence.

III. Causes identified with the personality: the insane act being associated with morbid physical conditions.

Of cases illustrative of the first class of causes we might

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adduce many examples similar to that of John Ovenston. Differing from moral insanity in many important particulars, though coinciding with it as regards the moral abandonment manifested in the act: distinguished from impulsive insanity in the predetermined direction of the act. The diagnosis in cases of this nature rests on the individual application of psychical principles—the relation of motives to the mental condition at the period of the perpetration of the act, rather than the accordance of motives to the character of the act. It is quite possible that motives actuating the insane may correspond to the ordinary operations resulting from a healthy though vicious mind. In such a case the predisposing and exciting causes are closely analogous to those adequate for the production of crime, and require for their just appreciation the nicest application of medical principles, which determine the value of a special symptom, not as an isolated phenomenon, but as the appreciable result of progressive, though possibly latent operations; to be estimated in its relation to the morbid condition it indicates, as well as to the sum of those general symptoms of which, perhaps, it constitutes the most important item.

In cases of this nature, as well as in the generality of instances, the period at which a physician is called on to give an opinion from personal investigation is a matter of importance to be considered. It may be that, immediately subsequent to the perpetration of a criminal act, the mental condition from which it had proceeded undergoes such a complete change that the responsibility of the offender becomes a question respecting which ordinary observers, forming their judgments from individual inspection, could entertain little doubt. On this point we have already quoted the opinion of Dr. Conolly, as expressed on Ovenston's trial. In this respect, the analogy existing between affections of the nervous structures and those which we term mental diseases is strikingly illustrated. In many instances where the nervous system is involved, it is observable that the constitutional disturbance, local symptoms, and special phenomena which precede and indicate some great climax, such as a convulsion or epileptic fit, after these have passed, completely and altogether subside until reaction be fully established, and the causes adequate for their reproduction again come into operation. In

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like manner, where unsoundness of mind exists, the commission of a startling crime has been followed by a complete, though it be but temporary, cessation of all mental disturbance, and such a state of quietude has ensued that it becomes a matter of difficulty for the inexperienced to credit the assertion that insanity had preceded and produced the events which constitute its chief evidence. Many examples of this important psychical fact will be afforded when the subject of insane impulse comes under consideration.

To the second class of causes by far the greater majority of cases of monomania may be referred. Esquirol has calculated the combination of hallucination with monomania at about 80 per cent. The process by which such a mental condition is accomplished finds in the progress of vice its analogy. At first a caprice, then a doubt, followed by a period of repose; a return of doubts, which from favoring circumstances become transformed to convictions, the more decided as they are the less probable. Intervals of rationality alternate with periods of delusion. As the disease advances, those intervals become shorter in duration and less frequent in occurrence, until at length the thoughts are so thoroughly occupied as to be rendered incapable of divesting themselves of the conception by which they are morbidly subjugated, and to which they are, therefore, irresistibly attracted. It is possible this essentially deranged mental process in one may so closely accord to the operations of health in another that until some circumstance leads to its consummation, its true nature is not appreciated; or it may silently progress and eventuate in criminal acts so inexplicable as to demand a close psychical investigation of motives which might possibly have induced their commission. The nature of the delusion may be as varied as there are different objects and different subjects to act or be acted upon, being equally dependent on the individual character and position as on those general circumstances from which it originates. The monomaniac, under the influence of his delusive conception, may fancy that his relation to all around is changed, and, actuated by such a delusion, perpetrate extreme acts. Or, while preserving his own identity, imagine that others are changed in their relation toward him; and, considering himself the object of special persecution, resolve on some act which he conceives is calculated to insure

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his personal safety. Though in the former instance there be a facility of detecting the special condition, it not infrequently occurs, consequent on the abnormal reasoning process which becomes established in a mind so affected, that its recognition is involved in much obscurity. In the latter it is quite possible that the criminal act is the first indication of the monomaniacal condition. In such a case the differential diagnosis as to the character of the insanity rests between premeditation—the offspring of delusion, and impulse—the result of a more general insanity. In contrasting the insane with its analogous criminal act, though we may have the former according to the deliberate determination of a depraved and wicked mind, it will, notwithstanding, be found to result from mistaken though apparently rational conceptions, adequate to subvert the healthy exercise of the judgment. Under such circumstances an inquiry may arise as to how far the apparent conjunction, rather than identification of crime and insanity, might warrant a modification of treatment, in which the rigid discipline of reproof and the curative resources of medicine should be conjointly exercised.

It is to this class of causes that the influence exercised by religion may be referred. The writings of Dr. Cheyne and others have fully shown the error of those opinions which would attribute to religion a capability of originating derangement of the mind. It has been satisfactorily proved that religion, *per se*, is not only wholly inadequate to such an end, but it is the surest preservative of that mental peace and proper regulation essential for happiness and identified with wisdom. "True religion, though by no means a complete preservative against mental derangement, affords the surest guarantee for sanity," since by it, those trials of life from which none are exempt are deprived of much of their bitterness, and the excitements of ambition, by which many are misled, are effectually subdued. Schiller could, therefore, say with truth that "Virtue was that form of mind most conducive to health, because it excites the most durable of all joys." It brings no sorrow in its train, and manifests no melancholy in its action. Opposed to this are those fanatic doctrines which sectarians promulgate, that excite, and, at the same time, agitate the mind; that preach ascetic truths and terrify the awakened sense. "We firmly belive," writes Dr.

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Cheyne, "that the Gospel, received simply, never since it was first preached produced a single case of insanity." In this, all who have felt or received scriptural doctrine will acquiesce. When, therefore, we read the histories of many who suffered in a similar manner to those melancholy anchorites whom Prosper Alpinus described as having witnessed in Egypt, "who looked black and filthy, and were dried and withered like mummies;" and hear of others who in profound grief for past sins, real or imaginary, sorrowed as those without hope; or, on the other hand, in joyous ecstasy imagined they were subjects of special sanctification and divine grace; though we are prepared to admit that both fanaticism and superstition may have caused similar instances of insanity, or, it may be, thus determined the form of the disease, we are not therefore warranted in considering such phenomena as the result of religion, but in the same manner as derangement of the mental faculties may succeed to misapprehension of, and ill-founded terror arise consequent on, a false conception respecting human law, so the erroneous estimate of divine truth may lend a particular feature to the operations of a mind previously wavering in its ideas.

It is thus that there are many of what are termed "religious monomaniacs" to be met with; who, like those unhappy fanatics, Arthington, Coppinger, and Hacket, executed in the days of Queen Elizabeth, may fancy themselves specially directed by heaven to accomplish particular acts; or who, like Martin, of later years, may think that in violating all human enactments they are thereby doing God service. When we recollect the solemnity and magnitude of the interests involved in religious considerations, and the important position such must occupy in all sane minds, we cease to be surprised that the mind, from any cause becoming deranged, while the thoughts are unsettled, and the imagination wandering without a fixed object, finding so fruitful a source for its extravagant exercises, and one so thoroughly adequate to supply food for reflection, should adopt some delusion identified with, or arising from, the magnitude of those interests therein revealed. Phenomena are thus superadded to a disease which exists: they are its consequences, not its cause. Religion, under such circumstances, does not overcome reason, but is perverted by it. The monomaniac fancies that he receives

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such a message as either communicates the will of God to him, or discovers certain truths which to others are unknown. His disturbed reason establishes a necessary connection between the matter of presumed revelation and a necessity for some particular act, the fulfilment of which proclaims his condition.

Again, the observations of Lord Penzance best sum up what we have endeavored to express: "It is not, assuredly, in the region of enthusiasm that we must look for the calm exercise of pure reason, temperate and well-balanced ideas, or exactness of logical thought. Still less must we expect that the fervor of fanaticism will follow in the slow steps of philosophy, reaching its conclusion by the graduated steps of proof."

"It is hardly, then, by the mere test of their reasonableness that the wild thoughts of religious enthusiasts can be brought to a standard for judgment of their sanity."

"But there are surely limits, even to so mythical a subject within which the human mind in a state of health is unreasonable or extravagant; and the common experience of life gives us a sense of those limits sufficient for the formation of judgment in most cases. To draw the exact line, if there be one, which defines such limits may be impossible; but to affirm that some instances surpass it, is not so. 'No one,' said Burke, 'can say when twilight begins or ends, but there is ample distinction between day and night.'"[27]

The third class of causes necessitates many psycho-physical investigations which physicians are alone adequate to institute. Those who have witnessed the progress of hypochondriacal insanity will at once affirmatively respond to a distinguished author's inquiry, who, when speaking of the psychical estimate of the actions of men, "the records of whose lives form the dark scenes of history, and present to the world a continuous career of morbid selfishness, crime, cupidity, caprice, tyranny, brutality, and vice," asks: "May not all these monstrous departures from ordinary and healthy modes of thought, impulse, and action, constitute evidence not only of depravity and vice in their ordinary signification, but of undetected, unperceived, unrecognized mental disease, in all probability arising from cerebral irritation, or physical ill health?"[28] In the case of Arnold, indicted at Kingston-upon-Thames, before Mr. Justice Tracey, in the year 1724, for felony

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in wilfully shooting at and wounding Lord Onslow, "it was shown that he had not only been long subjected to aural and visual illusions, but he was habitually under a variety of delusions; imagining, among other extravagances, that Lord Onslow was in his bosom, constantly persecuting him, and preventing him from eating, drinking, sleeping, or being at rest."[29] It is true that under circumstances of this nature little doubt might arise respecting the character of the act resulting from an intelligence so decidedly deranged. Other instances, however, will be met with, wherein the close association of the morbid condition and the insane act are by no means so apparent, although the dependence of the one on the other as certainly exists.

In the case of Luigi Buranelli, executed for the murder of Joseph Latham, the importance of duly estimating the relation which physical lesions bear to psychical operations was forcibly illustrated. On his trial, among other evidence adduced in proof of his unsoundness of mind, it was shown that he had manifested unmistakable delusions, not only respecting his physical state, but that these delusions, passing beyond his personality, assumed such a character, and were associated with such other psychical manifestations as, under ordinary circumstances, could leave no doubt respecting the mental condition of which they were the indications.

The details of this, a most important medico-legal trial, are elsewhere fully given, and the medical evidence philosophically discussed.[30] Its perusal cannot fail to impress psychologists with the necessity of appreciating combinations of disease, an analysis of which constitutes the highest exercise of the medical mind.

Two questions arise:

1. In what does hypochondriasis as a disease consist?
2. How is it to be distinguished from insanity?

The answer to the first involves the second of these propositions.

The mere fact of a disease receiving a special name implies its exhibition of some feature sufficiently constant to lead to its recognition. This feature must rest either in some determined pathological condition or essential vital phenomenon. The first argues a certain identity in physical causation; the second an equal uniformity in constitutional reaction. That

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in the generality of diseases such are found to prevail within cognizable limits, is a fact which enables observation to constitute experience. When we find medical men who have had great opportunities of obtaining knowledge differing, as in the case quoted, so widely in their views, we are naturally led to inquire wherein the source of error consists. The inferences at once suggest themselves that either the data for the formation of their opinions were undetermined or that the principle which should guide their appreciation admitted of error in its application. Observation assures us that it is to the latter this difference is chiefly, if not wholly, due.

For the determination of the true nature of hypochondriasis, we must assume many facts as admitted, whose proof, though by no means difficult, would still lead to extraneous dissertation. As a psychopathic problem, hypochondriasis, for its solution, requires a full recognition of the several actions and reactions which occur between the different nervous foci and the organs to which they minister, as well as of the reciprocal influence mind and matter mutually exercise. The first affords the nearest explanation of the various anomalous neural sympathies and visceral derangements possible by and through a known lesion. The second explains how, in the absence of any special attracting cause, long-continued mental depression eventuates in general physical derangement, manifest through the impaired action of viscera proportionately to their nervous supply; or how it is that disease affecting the viscera reacts on the general nervous system, and so disturbs that harmony essential for health. Causes primarily affecting the system and acting through it on the mind—causes originating in the mind and reflected from it on the system—prove adequate to alike interrupt those psycho-physical relations essential for health. These causes are as numerous and as various as the individuals affected. We are warranted in asserting that an impartial scrutiny of the material, as well as vital pathology of hypochondriasis, fails to identify it with any fixed physical accompaniment, or any necessary symptom in relation to such accompaniment. This is to a certain extent confirmed by the various theories which different observers have advanced respecting its pathological nature; the chief error of whose doctrines consists in their having mistaken frequent for essential phenomena, and so con-

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founded incidental symptoms, and the sources to which they were due, with the disease from which they had primarily proceeded. Pending inability to offer any definite explanation of the steps by which the condition termed hypochondriasis is accomplished, further than may be derived from the observation of its perfected phenomena; seeking how far the fact of variable causes producing uniformity in their result is explicable, we are led beyond the material structures to investigate the psychical nature of those feelings or emotions which become interrupted, and to seek there for some principle or feature, which, being common to all, may therefore constitute a point for subsequent research that will be available in each. This we possess in the simple recognition of those innate sentiments ordained by nature among her first laws—those desires for self-preservation which attach all equally to life. "Men," observes Bacon, "fear death, as children fear going into the dark." This feeling must be regarded as proceeding not so much from their love of life, nor apprehension of the future, as from that something in the abstract consideration of death which the best-regulated mind must acknowledge as being powerful through its very mystery, and capable of exercising on the greater majority of individuals an influence that they themselves may be scarcely conscious of. Until this principle be morbidly aroused, and the psychical sympathies associated with it called into action, the individual cannot be considered as hypochondriacal. However we may admit that a disarrangement of nervous functions, associated with, if not dependent on, a variety of organic lesions, forms the basis of hypochondriasis, it is not the organic change constitutes the disease, since its first, most important characteristic, and only constant symptoms, are those psychically evidenced through a morbid exaggeration of this natural principle; which, attracting the thoughts to the personality, constitutes it the centre around which the individual's hopes, fears, and wishes revolve—the special character of those thoughts being evidenced according to the particular nature of the organic lesion to which they are attracted. Hypochondriasis may be regarded as presenting two principal stages: that in which it exhibits the characters of a neurosis; that in which it has merged into a psychosis. The steps by which their union or transition is accomplished are so gradual that they are often

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difficult to determine. Considered as a neurosis, the inquiry arises as to how far its general and complex symptoms are dependent on the interminable union between the several nervous centres. Investigated as a psychosis, we seek if the suppositions entertained respecting the corporeal condition are explicable by possible, however improbable, deviations from an admitted standard of physical health. It is in its latter character alone that hypochondriasis is constituted a psychopathic question.

In its earlier stages, the morbidly excited attention being attracted to the personality, physical lesions become invested with special significance, when "disturbances of the animal sensibility, impressions which arise from without, and external sensations, give rise to numberless illusions." Reason and reflection prove adequate to guide the judgment for their correction. Local changes originate abnormal sensations; alterations in the nervous apparatus render it not only an unfaithful, but a pernicious messenger; yet so long as the judgment continues unimpaired, the sensations, however they may be misinterpreted, are not, as Esquirol has remarked, attributed to causes "repugnant to reason." As the disease advances, and the psycho-physical reactions become more thoroughly established, the capacity of appreciating the deceptive character of the sensations experienced, or the groundlessness of the suspicions entertained, become gradually lost, when from the clearest consciousness of their illusions, hypochondriacs pass through intervals of doubt to conviction, and a mental condition results which, in the fullest acceptation of the term, must be regarded as insanity. The mere fact of a disease being present affords no stronger argument for the mental responsibility of the individual, who, in consequence of its existence, entertains absurd, irrational, and morbidly-exaggerated conceptions respecting his physical condition, than does the existence of apparent grounds, or explicable motives for crime —as in Ovenston's case—argue the mental soundness or unsoundness of the individual perpetrating it. Winslow has well drawn the distinction between "mere errors or deceptions of sense," and such impressions as the morbidly-affected mind receives through the locally-impaired nervation. The confounding of the one with the other cannot fail, as in Buranelli's case, to open a wide path for discussion. In the former a con-

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sciousness of the erroneous impressions exists. In the latter the impression, of whatever nature it may be, serves as a pretext for the most extravagant mental exercises.

Admitting that a real cause for abnormal sensations exists, its presence cannot be regarded as any argument for the mental capacity of the hypochondriac so long as these sensations, being opposed to reason, are accredited in direct opposition to the evidence of the other senses; neither can the patient be considered as simply hypochondriacal, when, passing beyond the personality, those erroneous impressions influence his general conduct. There may be, for the purposes of prognosis and treatment, a wide difference in the affirmation that because a man is hypochondriacal he is insane, or that he is hypochondriacal because he is insane. Justice, however, requires that, for the determination of mental responsibility, neither the known preceding, nor the probable succeeding, mental phenomena should guide our opinion, but our examination of the mental condition at the period of the commission of the act under consideration. The transition of hypochondriasis into insanity is from many causes involved in obscurity; when, however, such is proved to have occurred, in the greater is merged the responsibility of the lesser disease. Allowing, for the sake of illustration, that the unmistakable change in Buranelli's character which became evident subsequent to a severe mental shock; that his acute mental depression and marked disposition to suicide; that his delusions respecting his physical condition, and the physician who attended him, and his association, to a certain extent, of his subsequent victim with these delusions; that the character of his correspondence and general conduct before the perpetration of the act for which he was tried; that the nature of the crime and his attempt at self-destruction—instead of, as has been ably shown, indicating suicidal melancholia and positive insanity which circumstances urged to their climax—were, as the physician examined on the part of the prosecution affirmed, explicable on the assumption of hypochondriasis, should we, notwithstanding, be warranted in the assertion that an individual so affected was also, in the fullest acceptation of the term, insane? In Buranelli's case we believe that such hypochondriacal symptoms—if hypochondriacal—as were present, must be regarded as the consequences, not the source, of the mental

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condition of which they were in a measure indications, his case being but a further confirmation of the psychical truth that the existence of a positive delusion, by whatever means it be produced, should be regarded as evidence of unsoundness of mind, and the individual responsibility be determined accordingly.

The consideration of monomania as a plea in extenuation for criminal acts must, from the complex nature of the questions it involves, be invested with varied and great difficulties. The necessity of carefully and fully investigating each particular instance, of making every inquiry a separate problem, to be decided on its own merits, will, as cases are presented, be the more obvious. By doing so we can alone hope to arrive at truth, since we believe it will be found that experience and observation attest—

I. That the law has failed to lay down such a definition as might indicate each example of monomaniacal insanity.

II. That the existence of monomania does not depend on the presence or absence of any particular symptom or group of symptoms.

III. That though the essential nature of the disease implies the existence of a delusion, the symptoms are not in all cases adequate to establish the nature of the delusion, or its association with a particular act.

IV. That though a recognized delusion may lead to the perpetration of a criminal act, the nature of the criminal act does not of necessity accord with the character of the delusion.

V. That the monomaniacal condition involving the delusion may have its origin in circumstances which, to the healthy mind, apparently admit of the most rational explanations.

VI. That the perpetration of a criminal act may be the first prominent evidence of such a monomaniacal condition.

VII. That the knowledge of the illegality of a particular act cannot be considered as evidence of a criminal disposition in the commission of that act.

VIII. That though the civil relations of a particular act be fully appreciated, its ethical relations in the mind of the monomaniac may to him invest its commission with the highest moral excellence.

IX. That though the civil and ethical relations of a par-

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ticular act be fully appreciated, its commission cannot therefore be considered as irreconcilable with unsoundness of mind.

X. That the co-existence of this knowledge respecting the nature of the act may to the monomaniac be the chief motive for its commission.

XI. That though the question of the legality, wisdom, or criminality of a particular act be open to the discussion of all, its psychical relations to the personality are essentially the province of the physician.

XII. That the question of criminal responsibility is one involving the existence of mental freedom, which demands an intimate knowledge of the psychical and physical constitution in their relations in the individual.

XIII. That this knowledge implies an investigation of the previous history and circumstances, and a due estimate of those various modifying causes, which, directly or remotely, may affect the inquiry at issue.

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CHAPTER III.

MORAL INSANITY.

In proceeding to the consideration of those insane states in which the exaggeration or perversion of the moral intelligence, or affective faculty, is that most evident, the intellectual powers being apparently unaffected, so constituting the "moral mania" of writers, we enter on as important an investigation as the intricate study of psychopathy affords. In the ordinary physical operations which are daily witnessed, similar combinations, when apart from vital influences, are found to eventuate in like results; experience imparts a capability not only for their accurate appreciation, but also for their predication, which capability is proportionate to the degree of certainty attainable in each demonstrative science. Medicine, while offering to the reflective mind the highest range of study such investigations embrace, at the same time opens a much wider field for induction; since, while duly estimating the importance of material relations, the reciprocity of action evinced by the several organs, and the varied physical changes explicable by organic laws, the mysterious influences associated with vitality must also be recognized; when the apparently diverse operations of a single law, or the concurrent operation of different laws, according to the circumstances which modify its development, or regulate their combination, come to be appreciated in their general as well as particular relations. The investigator of disease who carefully studies its progress soon learns to divest his mind of fixed rules, since instances not infrequently occur in which the most searching analysis fails to explain the rationale of vital operations, though observation at the same time satisfies us that there exists a certain uniformity in their conjunction. The truths of medical experience are not the less valuable because in many instances they are inexplicable. As our in-

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timacy with morbid action extends, scepticism diminishes: continued observation leads to the organization of knowledge; vital phenomena, as particular facts, are thereby referred to others more general, whose scrutiny, it is not impossible, may eventuate in the recognition of some principle in nature of which no explanation can be given, yet from whose estimation rules of great practical utility are derivable.

It is especially important that those who desire to justly estimate the varied characteristics of the disease about to be considered, be duly impressed with the true nature of the connection which exists between the moral and intellectual faculties. Such knowledge, while entailing an analysis of the mental constitution as appertaining to all, at the same time involves the careful study of those various circumstances capable of influencing its development in each.

The study of mental health, as identified with mental soundness, should form the basis of every inquiry in which the question of sanity is to be determined: without such knowledge treatment must be empirical, and opinions undirected by general principles prove valueless. This study, it has been by many supposed, demands a capability for abstruse speculations and metaphysical research, and is, therefore, invested with extraordinary difficulty. It will, on reflection, be apparent that the useful exercise of medical science is altogether remote from doctrinal subtlety, resting on evidences which, however in their ultimate analysis impenetrable to philosophic scrutiny, are, nevertheless, for the practical purposes of life, sufficiently appreciable.

On what does crime depend? Is it a simple psychical phenomenon, having as its essence logical errors? If so, the nearest approach to perfection should be found in the best-informed mind, and those who are wholly uneducated be of necessity the most criminal. Does the moral power, as it has been termed, exist so independently of the intellectual that it possesses a capability of carrying into practice innate aspirations, be they good or evil? If so, what mortal dare pronounce on the existence of guilt? Every day's experience disproves the first—the most limited observation refutes the second of these propositions. If, then, in the commission of crime neither the moral nor intellectual principle appears to act independently of the other, let us inquire how far they are identified, and to

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what extent their unity is involved, when resulting in the exercise of acts open to the charge of criminality.

The human mind has been regarded as a series of progressive developments, consisting of intellectual powers, moral feelings, and instinctive propensities. The former two distinguish man from all other created beings: the latter are identified with and common to animal natures. We are led to regard the moral or affective faculty as occupying a medium sphere, which is, therefore, to a certain extent identified with the intelligence in its psychical direction, and associated with the organism in its physical realization. From this medium sphere emotions spring, which, receiving the further co-operation of the intelligence, become desires; these, however dependent for their existence, must be admitted to exercise a reactive power, and to constitute in their turn so many incentives to intellectual action. Such a reciprocity amounts to a mutual dependency, and experience demonstrates that this, as contradistinguished from a unity, exists between the intellectual and moral faculty. Unless the balance of their power be maintained, the following results ensue: If the intelligence be rightly directed, it will prove adequate to preserve the emotional feelings in their legitimate course, and, by impressing motives of the highest order, enable the will to successfully combat natural desires. If the emotional feelings be suffered to proceed uncontrolled, they thereby acquire such an habitude as affords them undue power in resisting the psychical suggestions associated with them, and further enables them to reject those innate counsels of the moral faculty or moral sense to which, under ordinary circumstances, they are wont to respond. At length, through such a process, the emotive feelings, acquiring the mastery, are enabled to not only involve the volition, but also to render the intellectual powers the active, though depraved, instruments for their gratification.

Many causes are thus adequate to produce a similar result. If the purely intellectual powers be interrupted in their action, they fail to direct the moral or affective faculty. When the normal relations of the organism become impaired, the emotive feelings, as being closely related to the personality, evince the change. Should the emotions, not controlled, through the insensible co-operation of both intellectual and moral spheres, acquire undue power, a want of harmony speedily

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pervades the whole system, evidenced on the one hand by ill-regulated passions, and on the other by disordered functions. In fact, the relationship of these three is from observation proved to be so intimate and complete that he who would determine the question of mental soundness in connection with responsibility, without duly weighing the separate influence of each, but imperfectly estimates the importance of such a duty.

Feelings of pleasure and pain, being developed coincident with the maturation of the living structure, may be regarded as to a certain extent forming the natural basis or guide to each voluntary movement; thus furnishing the groundwork for all subsequent intellectual actions which such movements entail, since pleasure and pain, in their physical associations, by a process of assimilation, become identified with right and wrong in their physical relations, as something to be desired or avoided. Reasoning from analogy, the foundation of an ethical code—this moral sense to which we have alluded, or intuitive moral perception—may be considered as being identified with each mental constitution, in the same manner as the vital sense of material operations rests in every physical organization. Those principles in the lower animals, wanting the direction of reason, are wholly impulsive, constituting their instincts; which, resulting from the dictates of an unknown principle, appear not only uniform in animals of the same class, but are also performed without a knowledge or consciousness of their ultimate results. This instinct, requiring no experience for its guidance, fulfils to all intents the purposes of an intelligence; and since in brute life there is no accountability beyond the individual, the most perfect gratification of animal desires may be presumed as the *summum bonum* of their existence. Man's reason admits of no comparison with such instinct. Those desires he possesses in common with other animals rest not only within the control of his will, but are also capable of being influenced by the separate mental agencies which eventuate in its formation. Were it not so, life would present a perfect chaos of ungoverend passions, since, in addition to its natural impulses, artificial appetites become, as it were, self-engendered, the insensible results of habitual exercises.

That in man this moral faculty or moral sense, endowed

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with a certain authority, exists, is sufficiently evident from our individual consciousness. We admit that the positive obligations of life, as regards their prudential relation, demands the guidance of the judgment, which preargues the possession of experience. Our moral instincts are, however, the promptings of natural principles, coexistent with, though for their essential being independent of, psychical perceptions; but not the less on that account requiring, for their proper development and direction, intellectual culture. Right is a positive term which admits of no perversion. A sense of right exists, independently of those intellectual powers which guide its operation. The whole world lives under a moral government. "Yea, and why even of yourselves judge ye not what is right?" asks our Lord. Again it is written: "The Gentiles, which have not the law, do by nature the things written in the law." Whence, then, proceeds crime, man having as a guide his natural conscience? Observation of life affords this reply: He is at the same time the creature of his natural appetites. Our study, therefore, of the manifold operations of the latter, as manifest in the world around us, and our careful analysis of the varied circumstances associated with each criminal act, promise to afford the best explanation of the question we are discussing.

Admitting in each the presence of an innate moral principle, it may be asked: Whence arises the wide range of differences observable in the ethical judgments of men, and how does it occur that those judgments are capable of being modified by their intellectual operations? To this we reply: The sense of moral perception does not in its practical application appear to be as uniformly guided as it is universally bestowed. The moral appreciation of the qualities of different actions, in reference to the same object, implies an elective power involving the exercise of the intelligence for their discrimination and its co-operation for their adoption and exposition. Though, then, the moral standard be fixed for all, ethical judgments are found to vary with many, not so much from any original diversity of their moral sense, but according to the acquired perceptions of existing relations as submitted to that sense. We have used the term "original diversity of their moral sense;" for we believe psychical analysis will sufficiently establish it as a fact that in the moral, as in the intellectual

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constitution, individual dispositions will be found to exist, which, though amenable to general rules, are not the less on that account particular examples. This will be evidenced as we proceed.

Were this moral sense, as being an essential part of the human constitution, by itself capable of active exercise—that is, of not only determining on that which was right, but also of insuring its adoption—men should, in accordance with an admitted law of their natures, be not alone universally and intuitively, but necessarily, attracted to that which is good, its practice being essential for their immediate enjoyment and ultimate preservation. The intelligence would then be invariably occupied in performing moral exercises. We see that it is not so. Were we to regard morality as merely the issue of prudential considerations directed by rational self-love, the question still remains to be determined: Whence is derivable that regulating principle which, under circumstances of the greatest complexity, is capable of its uniform direction? These questions have worthily occupied the greatest minds. Their practical elucidation may be assisted by a reference to our individual consciousness, as well as to our general observation, when we shall be satisfied that many of our daily exercises must be referred to a principle of action occupying a middle sphere, where the mental and moral intelligence, as it were, meet, co-operate, or react one on the other. This psycho-physical plane, or "conscience," has been presumed to be capable of furnishing to every one an invariable rule of right or wrong. Metaphysicians and theologians have defined moral and religious duty as an accordance to such rule; while lawyers—with what propriety we have already stated—have made the test of responsibility, as identified with soundness or unsoundness of mind, in criminal cases to depend on the presumed ability or inability of the offender to determine on the recognition rather than the adoption of that which was right or wrong at the time of the commission of any particular act.

Before propounding the doctrine that the same standard of conscience appertains to all, we should establish the existence of their equal capability for the appreciation of right and wrong, not in its abstract, but relative sense. We use the term abstract, for we believe that a positive consciousness of evil appertains to every one in the commission of certain acts;

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and that this consciousness, however perverted, is never wholly lost, inasmuch as should the intelligence prove inadequate to their recognition, the mere instincts of animal nature would rebel against them. That conscience is to be distinguished from reason may be inferred from the history of crime. That it is closely associated with the intelligence is demonstrated in the code of morality which savage nations possess, as well as in the fact that where the moral sense is non-existent, the powers of the understanding are either undeveloped or destroyed. "The wretch," writes Winslow, "devoid of conscience is of course morally defunct; but we must never forget that conscience is a relative, not an absolute, term, and that, like other faculties of the mind, it requires education, direction, and discipline." Allowing that moral commands are to be distinguished from positive duties, we must in our estimate of the latter admit that the just appreciation of their moral relations is essential for their proper guidance. "Every moral judgment is relative, and involves at least the comparison of two terms: when we praise what has been done, it is with the coexistent conception of something else that might have been done; and when we resolve on a course that is right, it is to the exclusion of some other course that is wrong." If, then, in the preference of one class of motives to another, the moral rule of action consists, a question arises: How is the value of various conflicting motives to be estimated? The answer rests: By the universal standard of right, which the intuitive perceptions of the individual, the general judgment of men, and the positive ordination of heaven, furnish to each. Is each one equally competent for their estimate? This is an inquiry, opening a wide field for ethical discussion, which we forbear to enter on, further than observation of life warrants, a limited range of which suffices to establish the truth of Stewart's remark that "Fortunately for mankind, the peace of society is not intrusted to accident, the great rules of a virtuous conduct being confessedly of such a nature as to be obvious to every sincere, well-disposed mind. It is in a particular degree striking that while the theory of ethics involves some of the most abstruse questions which have ever employed the human faculties, the moral judgments and moral feelings of the most distant ages and nations with respect to all the most essential duties of life are one and the

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same."[31] Being led to seek for an explanation of the causes of the diversity of our moral action in a scrutiny of the agencies conducing to the development of the moral sense, we are impressed with the observation of an eloquent writer: "That the early repression of all the higher feelings, and the influences constantly at work to develop the lower, fail not to fix the standard of right and wrong at a very different point from that which a better education would have determined in the same individual." It is of importance to rightly estimate what this fact indicates; for from it we may infer that in individuals of such a class, while the functions of the understanding continue perfectly unimpaired, the passions may prove capable of inducing them to the commission of acts whose criminality finds an accordance in those habitual exercises of which they may be presumed to constitute but the exaggeration. In the study of moral insanity, its evidences will be found to rest in operations to which this accordance of the intellectual faculty appears wanting. On this apparent want of unison is based the difference between crime and this particular form of disease. Omitting those positive duties of life which are performed with the insensible approval of our moral faculty, we come to the question: How far is the voluntary exercise of our emotive faculties regulated by our conceptions in reference to the objects to which they are attracted? We are satisfied that the intelligence, if not chiefly instrumental, is at least essentially involved in all their deliberate exercises. It is not, therefore, easy to believe the emotive faculties can be altogether perverted so long as the conceptions which had previously, under similar circumstances, influenced their direction continue unchanged; while, at the same time, it is by no means difficult to admit that the change in our conceptions may be alone manifest through the affections with which they are associated, when, as Dr. Duncan observes: "Cases occur in which an estrangement of the moral sentiments takes place without any obvious lesion of the reasoning powers." If we go to the full extent of some writers, and allow the moral intelligence to be, *per se*, diseased, or "manie instinctive sans délire" to be present, while the reasoning powers are wholly unaffected, what else can we suppose but that every case of confirmed viciousness is an example of such a form of disease? As in the mental, so in the moral

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constitution, the most marked differences are perceptible. It requires but slight research to satisfy the inquirer that many instances of crime are on record, and that many examples could be adduced to prove that such an original deficiency or natural perversion of the moral faculty appertained to some individuals as argued a brutality rather than depravity of their dispositions. The chronicles of crime and pages of history too sadly demonstrate that instances are not wanting, in which the most wanton and flagrant violation of the ordinary principles of humanity has been exampled by the acts of many whose conduct otherwise could not admit of a doubt respecting the existence of intellectual power adequate to appreciate the varied relations of their acts. Are such cases to be regarded as examples of "moral insanity?" If so, in what respect do they differ from others which may be adduced as evidences of wicked, depraved minds? Observation satisfies us that the same vice for its accomplishment adopts means which vary according to the natural character, education, position in society, and various modifying circumstances affecting the individual. How true is the remark of Dr. Wigan: "Place the individual subjected to morbid impulses in a position of impunity, so low or so high in the social scale that he is either above shame or below it, and we see how much of the morality of society depends on positive law, how little on virtuous self-restraint." Society, in seeking to disguise from herself this truth, calls the act of the one "wildness," of the other "crime," attributing the first to the weakness of the head, the second to the badness of the heart.

However open to disputation the origin of our moral nature may be, its use and the means best calculated for its guidance happily come within the observation of all. In the study of the latter we dissipate much of the obscurity of the former, and are practically convinced of the importance of recognizing in the mental constitution that same harmonious coadaption which, witnessed in our physical organization, illustrates a mutual dependency of the various structures constituting the whole; and further displayed by the various operations in the world around us, proclaims a unity of design as indicative of the wisdom of the Creator.

Among the principal of those means by which our moral nature is affected, we may enumerate education and associa-

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tion. In regarding them as fitting subjects for psychical inquiry, we recognize the primary elements of national greatness and individual happiness. As man advances to physical maturity his mental powers simultaneously progress; moral and intellectual faculties become developed—desires, as contradistinguished from instincts, awakened. These, though identified with his moral nature, imply a power of reasoning; for, coincident with their development, a capability for the estimation of cause and effect is also manifested. As, however, no correct judgment could be arrived at without the due appreciation of data, entailing experience, one of two things must occur—either the instinct should guide the reason until such time as experience became established; or, as is the case, the value of data, *in initio*, be acquired from the experience of others, who by education lay the first step of that independent intellectual life which, through a similar process, had in their own persons become established. On this point we quote from Dr. Wigan: "The slow progress to physical maturity of the human species, compared with that of other animals, seems a provision for their longer pupilage and more extensive instruction. If this duty be neglected, or if the discipline be defective or erroneous, the animal grows up the most detestable combination of intelligence and physical force that infests the earth."

It is not our province to descant on a subject respecting which polemical arguments run high; yet considerations arise, from the nature of our present inquiry, which induce us to ask—Has crime decreased in proportion to the spread of education? "Has eating of the tree of knowledge diminished the power of the Tempter?" Are the best instructed the least vicious? So far from such being the case, it has in numerous instances been found otherwise. If we investigate the cause of this, we are led to the recognition of the moral, even more than the intellectual constitution of man, and are impressed with the truth that as there is an education of the intellectual faculties essential to man's temporal interests, so there is also the cultivation of his moral virtues no less essential for his present and eternal welfare. Proportionate to the maturation of the intelligence is the extension of its sphere of enjoyments; new desires are thereby awakened, new wants called into existence. How are these to be efficiently gratified or supplied, except by identifying man's moral with his intellectual

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progress, and so, while imparting to the masses knowledge, inculcating principles which may make them understand that moral restraint is a duty and that their duty and interests are the same? Truly has it been written: "The chief means of controlling the passions and of keeping them within just bounds is to form a proper estimate of the things of this life, and of the relation of our present to a future state of existence, and of the influence which our actions in this world will have on our happiness hereafter." The best-informed mind requires to be regulated and subdued; regulated by the careful direction of the affective faculties to objects of legitimate attainment—subdued by the habitual adoption of such practices as denote that to the corrective influence which the various emotions exercise one on the other have been superadded motives of a higher and more exalted character, which the intelligence is enabled to place in successful opposition to the natural desires. It is to be lamented that, notwithstanding the most careful mental and moral cultivation, abject depravity is not infrequently manifested in the conduct of many having every incentive to a virtuous life. We are not warranted on this account in declaring that training of this nature is powerless in preventing the operations of vice. It is, however, true, that with such the desires may be inflamed without the understanding being strengthened, the imagination excited without the habits being improved, the cravings increased while the heart continues unpurified. Those cases are problems in human nature whose explanation would involve an exposition of the laws by which the Creator determines his moral government of the world. As our estimate of a benefit is proportionate to our conception respecting it, so our moral culpability must be presumed as being in a ratio to our capability for ethical decisions. In our psychical estimate of crime we cannot, therefore, reject the influence which education exercises, or should exercise, in fitting or enabling the mind to appreciate not only the impolicy, but also the immorality, of any particular act.

The influence of association on man's moral disposition has been recognized by every one who has investigated the progress of crime. Profligates congregate together; their socialism has for its root real practical evil. The depraved in mind and abandoned in morals find mutual attraction; they recip-

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rocally justify each other from their inward accusers, while establishing for themselves a system of morality up to which they act. In tracing the progress of crime we recognize the self-abandonment of the natural mind, in which the disinclination soon gives place to an inability to perceive moral distinctions; as guilt with its skilful sophistry stifles each remonstrance of "the still small voice within," the conscience, through vicious practices, becomes in its sensibility gradually impaired, and ultimately ceases to respond. Moral responsibility is not in consequence removed. Were we to admit it as being so, we would thereby confer a premium upon vice; for as a man became thoroughly lost to a sense of right would his immunity from that punishment be established, which possibly might prove adequate at least to deter others from similar courses, should it even fail in reforming himself. The statement that similarity of disposition regulates intimacy has become a proverb: its truth as an element in the formation of our opinions cannot for a moment be lost sight of.

This intimate blending, intricate co-operation, and mutual dependency which the various faculties of a healthy mind preserve one toward the other must be carefully distinguished from their integral unity. We have observed that "in our analysis of mental activity, as evidenced through psychical actions, we are presented with a duplicate operation of an integral power, contradistinguishing the moral from the intellectual faculty." This it has been our object to maintain, being entirely impressed with the wisdom, practical utility, and truth of Winslow's observation that "these faculties, although co-operating and blending together, are so many distinct powers, differing in their modes of operation and subject each in its turn to characteristic aberration; but as the mind can be only occupied with one idea at a time, it is as a whole affected when under the influence of any specific lesion." [32]

The "mens sana in corpore sano" implies the free action of the mind rather than its free existence, since the relationship of the healthiest mind to the cerebral organization is too well established. In like manner would we associate the moral and intellectual faculties, and consider the normal mental condition to rest not so much in the mutual independency, but in the capability for the free co-operation of those separate powers. The free actions of one individual and the mor-

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bid actions of another may be identical—moral excellence characterizing both. Again, the insane acts of one may be the habitual and premeditated acts of another, vice being the leading characteristic of each. In what does their difference consist? We are not at all times able to detect the positive existence of disease, though we may justly infer its presence; nor, having established its presence, can we always determine its nature. In such cases we form our diagnosis by negation—that is, by establishing what the abnormal condition is not, and so indirectly arriving at that which it is. It is thus that in our estimate of "moral insanity" the acts must be judged of by the motives, the motives by their relation to the mental condition, whose operations they may be fairly presumed as indicating.

Comparison as an important element in diagnosis cannot be too highly valued, the facility of arriving at truth being generally in the ratio of our capability of applying this test. In our investigation of the disease we proceed to consider, this will be abundantly manifested.

All examples of moral insanity which the records of criminal jurisprudence supply may, we conceive, be ranged under one of the following heads:

I. Cases in which the development of the moral feelings or affections is originally deficient.

II. Cases in which the perversion of the moral feelings or affective faculties occurs incidentally.

III. Cases in which the moral feelings become universally disordered.

IV. Cases in which the moral feelings are partially diseased.

The first class of cases is often involved in much obscurity. Education presupposes the existence of certain capacities common to all; its exercise demonstrates that these are variously extended to each. There are many whom no amount of intellectual culture would render competent to the discharge of duties performed without difficulty by others. Except on the supposition that an original peculiarity of mental constitution exists in such individuals, this fact is inexplicable. An analogous condition is manifest in the operations of the moral faculty, inasmuch as individuals in all respects similarly circumstanced display the greatest possible diversity of character.

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Many without any unusual incentive to crime, and with every possible inducement to virtue, are observed to wilfully abandon themselves to evil practices, and from the commencement to manifest a disposition presenting a strange compound of intellectual power and moral culpability. Their disease is vice. With them Professor Heinroth's views are so far established that moral depravity is not only the first step to, but the real cause of, their mental derangement. Pinel has directed attention to numerous examples of this nature. The identity of their operations with those of vice is complete, from which they are alone distinguished by the exaggerated malevolence they display; since "without other inducement or advantage than the gratification of morbid appetites, acts of the most heartless and repulsive nature are by them being continually perpetrated." That to individuals of this class the emotional theory of insanity applies, we do not doubt. The primary cause of their mental derangement can be assignable to no other source than that abnormal excitement which, resulting from the uncontrolled gratification of the passions, too truly proves that they may be rendered so many "fevers of the mind." The question of responsibility under circumstances of this nature is one closely identified with the preservation of public safety and morality. Indifference to and negligence of those moral commands on whose observance the welfare and peace of society depend cannot be permitted. The interests of the community demand that they be preserved from the evil consequences which might ensue from the free gratification of vicious desires. The welfare of men requires what their universal voice declares—that when the animal nature is thus by the individual allowed to gain an ascendency, its powers should be chastened and subdued, in order that, being brought into subjection, the lessons of experience, if not the dictates of conscience, may thereby prove adequate to their better regulation. Fortunately, to this form of moral derangement the same rule applies which in physical disease is found to prevail, for as in the latter, when so perfect an analogy exists between organic affections as to render them closely similar, their treatment is usually equally so. In like manner we believe that in this affection, the same moral as well as physical discipline the legislature ordains for the reformation of the vicious is as equally applicable to their condi-

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tion, except when it eventuates in the perpetration of a capital offence, and then it will generally occur that more marked grounds for opinions are not wanting.

The most difficult and complex propositions arise when the mental and moral powers seem equally defective. Few cases excited more interest than that of William Frederick Wyndham, heard in 1862 before Mr. Commissioner Warren—the petitioner being his uncle, a major-general in the British army who had attained high distinction. The most celebrated advocates and gifted lawyers of the present century—Earl Cairns, Lord Coleridge, Mr. Justice Field, Mr. Justice Hawkins, Sir John Karslake, Sir Charles Russell—appeared for the respondent and his immediate family; Mr. Montague Chambers and others, including the author, being for the petitioner. The petition alleged a connate mental deficiency which prevented the respondent exercising a sound mind sufficient for the government of himself, his manors, messuages, lands, tenements, goods, and chattels"—deficiency, within the interpretation of Sir John Nicholl, understood to mean not "that he was born either an idiot or a lunatic, but that his mind was naturally and constitutionally defective, and that its defect was not occasioned by any accident or supervening disease."[33] The commission lasted thirty-three days. Though the jury found in favor of the respondent, his costs were ordered to be borne by the estate. He died within one year after the verdict, having in the mean time been separated from such friends as he possessed, and wasted every shilling within his reach (£140,000) in companionship entirely unworthy of his birth and station, being a pauper at time of death, which took place in a low public-house. It was contended on his behalf that the maxim "*sic utere tuo ut alieno ne lædas*" was the only restriction our laws imposed in regard to economical prudence. The opinions of Blackstone and of others were relied on by Sir Hugh Cairns in support of the proposition that "prodigality which causes great houses to fall and hereditary estates to pass away, thereby occasioning that frequent circulation and transfer of lands and other property which cannot be effected without extravagance somewhere, is perhaps not a little conducive toward keeping our mixed constitution in its due health and vigor." This and the doctrine of Lord Hardwicke, "there may be a weakness of mind that may render a man incapable

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of governing himself from violence of passion and from vice and extravagance, and yet not sufficiently under the rule of law and the constitution of this country to direct a commission," were urged with success on his behalf. Against Lord Hardwicke's opinion was quoted that of Lord Eldon: "I have reason to believe the court did not in Lord Hardwicke's time grant a commission of lunacy in cases in which it has since granted. Of late the question has not been whether the party is absolutely insane, but the court has thought itself authorized (though certainly many difficult and delicate cases with regard to the liberty of the subject occur upon that) to issue the commission, provided it is made out that the party is unable to act with any proper and provident management, liable to be robbed by any one under the imbecility of mind not strictly insanity, but as to the mischief calling for as much protection as actual insanity." The petitioner did not seek to place his case higher than this; keeping in view the observation of Sir John Nicholl: "Imbecility and weakness of mind may exist in different degrees between the limits of absolute idiocy on the one hand and of perfect capacity on the other." The trial was instructive as showing the value of evidence when submitted to a jury whom sympathy or prejudice could influence. Witnesses with equal opportunities to form opinions were in direct conflict as to habits, dress, manners, bearing, temper, and knowledge of the respondent. Medical experts of the highest position proved to be in a similar antagonism. "From his cradle to the age of twenty-one years," observed Mr. Coleridge, who appeared for his wife, "Mr. Wyndham was utterly neglected by all his family, with a set of second-rate tutors about him who did not understand and were incapable of dealing with their pupil." Mr. Karslake, on behalf of respondent, admitting he had not been wisely or prudently directed, asks, if he were as described, "Would he have been kept so long at Eton, or could he have induced gentlemen of education, ability, and position to live and travel with him?" Mr. Montague Chambers replied: "No young gentleman ever had more care and anxiety bestowed upon him; no young gentleman of his rank ever had more money laid out upon him; but trial after trial had failed, and his mind remained a barren soil incapable of cultivation." This was the comment on the absence of the "wisdom or prudence" referred to by

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Mr. Karslake; high-sounding words when mental weakness on the one hand and commensurate moral deficiency on the other constituted a disposition impervious to instruction and incapable of self-regulation or control. Perhaps the severest criticism was that contained in the opinion of Dr. Conolly: "I believe that if Mr. Wyndham had one kind, virtuous friend he would get through the world very well."

Society, wise after the event, observing the effects of the finding of the jury, took up the question and quoted the dictum of Lord Hardwicke: "Possibly the law was too strict; and it might be useful in some cases that a curator or tutor should be set over prodigal or weak persons as in civil law," and advocated in its journals that such spendthrifts should have a curator appointed to hold office until *perfecta ætas* (25), so that although a person similar to the respondent be *sui juris* and of an age to exercise his rights, yet it woud be for his safety to insure that he did not hurt himself and his family by the mode in which he exercised them; the lord chancellor having a power of dispensation if a sufficiency of self-control was in the interim manifest.

In answer to the argument that the petitioner had desired to possess himself of the property of the respondent and to nurse his estate for his own benefit, Lord Justice Knight Bruce in a contemporary case[34] observed: "It was a mistaken idea entertained by many, that the finding by a jury that a person was of unsound mind necessarily involved an interference with his personal freedom. The court placed no further restraint upon a lunatic than was necessary for his protection, and several lunatics were under the protection of the court now residing with large establishments in their own houses."

As we write, a sad illustration of that prodigality to which Blackstone refers presents itself. A youth without previous training to spend a fortune wastes £250,000 in two years, and terminates his short career by inconsiderate forgeries, the criminal magnitude of which offence he appears to have but imperfectly appreciated. Found guilty on the charge of "*escroquerie*," in a foreign prison he has three months for self-examination. Surely it may be asked—Is there not a suggestive teaching in this? Had he in the multitude of his advisers no one compassionate friend? Is it not miscalled "freedom of action" that permits a youth to thus consummate his ruin?

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The extravagances of Wyndham elicited the indignant censure of the press. Similar prodigalities, detailed through a vicarious authorship expressing fictitious regrets, constitute in the present time "one of the fashionable novels of the season."

The second class of cases, in which the perversion of the moral feelings incidentally occurs, is much less difficult in their recognition than in determining their responsibility. When we consider the various powers which, irrespective of religious sense, regulate the conduct of men; that influence which society, the laws, public opinion, and our mutual dependency exercise for the promotion of self-control and the maintenance of the general welfare, and then reflect on the capability of self-regulation which, consequent on such, is manifested to a certain extent in the conduct of many admittedly insane, we are struck with the preservative influence we each contribute to, and cease to be as much surprised as we otherwise would be, that when those corrective powers are removed, individuals in whom a defective capability of self-regulation is manifest should by their conduct betray the same, and, wanting that restraint which had hitherto existed, abandon themselves to the freer indulgence of those passions that mark the natural disposition of man as being essentially sinful and depraved. This condition, we conceive, may result from either of the following causes:

I. The abnormal excitement of the passions, consequent on some morbid physical condition.

II. The defective or imperfect development of the mind.

The first may result from either a morbid condition of the general system or a special condition capable of generally affecting the system. We believe that many cases of hysterical mania are examples of the first class, and that many local diseases afford illustrations of the second. That causes capable of morbidly exciting the passions are adequate at the same time to also affect the mental powers in their regulation of those passions, the majority of examples proves. The fact is, in many instances the general conditions of the system and the influence such conditions exercise on the intellectual powers are not sufficiently appreciated; and yet we require no proof beyond the experience of our daily observation to show that circumstances wholly unconnected with certain actions

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or particular states of mind may lead to one or eventuate in the other when, pending the continuance of those circumstances, the individual becomes incapable of opposing the morbid influence they exercise. Familiar examples of this form of disease are also manifest, as has been indicated, in the unusual phenomena which occur with some females during the period of utero-gestation, as well as the difference of disposition and perverted states of mind that with them may be fairly presumed to be dependent on causes generally affecting the system, but having no special tendency to those particular manifestations to which they, from accidental circumstances, may be determined.

Morbid conditions affecting the intellectual system in a manner similar to that which Esquirol and Georget describe as indicating the initiatory stage of mania may, from whatever causes these morbid conditions proceed, in their primary development be manifested exclusively through the emotional faculty. It is quite possible that, pending the progress of cerebral disease, appearances of perfect physical health may be presented to the most careful scrutiny. Why disease of the brain should, not infrequently, manifest its presence through emotional operations, pathology fails to explain. Its doing so is too often demonstrated by the fact that changes in the affections, sad, lamentable, and at the time of their occurrence inexplicable, have been found to precede unmistakable and fatal outbursts of insanity. It may be that purely psychical changes as frequently occur; but inasmuch as they are assignable to so many causes, and without the presence of disease so constantly take place, they therefore escape detection; while the affective faculties, having a fixed relation, are in their alterations more immediately recognized. Heinroth and Hoffbauer have observed a form of mental derangement, of which the latter thus writes: "It is clear that mania may exist uncomplicated with mental delusion; it is, in fact, only a kind of exaltation, a state in which the reason has lost its empire over the passions and the actions by which they are manifested to such a degree that the individual can neither repress the former nor abstain from the latter. It does not follow that he may not be in possession of his senses and even his usual intelligence, since, in order to resist the impulses of the passions, it is not sufficient that the reason should impart

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its counsels—we must have the necessary power to obey them."[35]

Before arriving at any conclusion in reference to cases of this nature, it is of importance to consider fully—

I. Those previous circumstances which have influenced or tended to form the moral character.

II. Those especial circumstances which have eventuated in the particular development of its affective operation.

On the first query—The psycho-physical relation or temperament, the influence of education, association, and habit, as establishing the individual mental constitution, must, in their mutual reactions and collective operations, be duly estimated.

On the second query—All physical causes adequate to react on the material organ for intellectual expression require the closest investigation. The influence an ascertained morbid condition is capable of exercising, not on an ordinary intelligence, but on the mind of the individual accused, demands the most careful scrutiny previous to determining the relation of the ascertained mental constitution to any particular development of its moral faculty. The question of responsibility in cases of this nature is therefore one involving the nicest exercise of psychical judgment.

The third class of cases, in which the moral feelings appear to become universally disordered, is closely associated with those last noticed. Their diagnosis rests on the recognition of an independency in existence, but unity in action, of the separate mental faculties as being characteristic of mental and physical health. Were proofs required to establish the reactive influence mind and body mutually interchange, we might quote a case of unusual interest tried in Dublin,[36] in which this proposition was painfully illustrated in the person of an educated gentleman, who, pending the constitutional inability for moral control consequent on the presence of nervous depression induced by an overwrought mind, suffered from such a perversion of the moral principle as led to the indulgence in irregularities which no one doubted his ordinary life was wholly opposed to, and his unclouded intelligence would have altogether repudiated. Winslow has directed attention to similar anomalous phenomena which are to be met with in certain stages of hypochondriasis. He observes: "The

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phenomena may also manifest themselves not merely in the common forms of weak fancies as to bodily health or in unaccountable gloom, but also in a less understood form, in which the judgment is weakened and the individual gets committed to some intellectual folly in science or literature, religion or politics. The man is not actually insane; there is method in his madness; but his feelings are easily acted upon, his credulity is unbounded, and his actions consequently unworthy his reputation or his intellect."

When we reflect on the difference between men which education, association, and habit are capable of producing, we are led to the conclusion that motives or inducements to crime capable of influencing one individual are perfectly harmless in their operations on another, and that acts indicating a wilful viciousness in one too plainly demonstrate a morbid want of self-control in another. The comparison of those acts regarded as denoting the moral derangement of an individual, by determining the relations they may bear to the previous conduct and general history, lays the groundwork on which the diagnosis of this general condition rests. This is a question which, while for its rational decision coming within the reach of an ordinary intelligence, at the same time, for its medical solution, demands a close examination of the personality for the detection of disease; since observation assures us that many general and special sympathies may be evoked through its existence, adequate to so disturb the mental equilibrium that the moral power ceases to be regulated or controlled. It is true that in life many are to be met with to whom the ordinary observances of society become matters of indifference: who, from having preserved all appearances of moral rectitude, seem to wilfully abandon themselves to vicious practices. If the intelligence approves or co-operates with such immoral acts, of whatever nature they be, they thereby constitute so many illustrations of premeditated vice. If the intelligence does not approve and the immoral acts be opposed to its dictates, does not the commission of such acts argue as much the inability of the intelligence *quoad* the morals as any independent morbid condition of the distinct moral faculty?

So far we believe our views to coincide with those of Hoffbauer and others, who have justly observed that at the moment of the insane immoral act the perception is also disturbed.

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There is nothing in the analogy of disease to lead to the inference that in cases in which the moral faculties are chiefly involved the intelligence should be presumed as sound, because no other evidence of disease is present except that manifest through the defective morals. On this particular point we adopt the words of Ray: "Notwithstanding the correctness of his conversation and his plausible reasons for his singular conduct, a strict scrutiny of the actions of a patient laboring under moral insanity, if not of his words, will convince us that his notions of right and wrong are obscured and perverted, and that his own social position is viewed through a medium which gives a false coloring to its whole aspect." In proof of this we may observe that the majority of well-marked examples of moral mania have eventuated in other more marked derangements of the intelligence. Thus the oft-quoted case of Frederick William of Prussia is adduced as an example of this form of disease; but surely any one who studies its different peculiarities will admit that there was abundant evidence of his general mental unsoundness, equally manifested by his monomaniacal desire for tall recruits as by his brutal conduct to his son. Dr. Duncan, in his essay on "Moral Insanity Unaccompanied by any Obvious Symptoms of Intellectual Aberration," gives the details of an interesting case, in which the moral relations of the sufferer appeared by him to have been wholly misconceived while the moral perversion consequent on this misconception, was the principal evidence of the disease. In his observations referring to this case, Dr. Duncan asks: "Are we justified from these things in concluding that there was no morbid condition of the understanding all the time?"[87] and adds as his opinion that which the majority of examples proves: "The morbid condition of the understanding, though obscure, was nevertheless real."

The fact that the knowledge of right and wrong is not prominently present to the mind, *per se* affords no proof that the moral principle is diseased. Observation has shown that the habitual indulgence of evil habits may stifle the voice of conscience and overcome those feelings which the commission of the same acts would occasion to less hardened individuals. Human life may be held at a pin's fee; and, as there is sad evidence to infer, a graduated scale for its destruction be adopted. "The abject atrocity of an act, its voluntary nature,

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its perfectly gratuitous character, argues nothing in favor of a diseased moral principle further than vice, wickedness, and crime are competent to such an end;" nor does the circumstances of a man's apparently correct life of itself offer other than a presumption that the abandonment of those principles by which he had been regulated is the result of disease, even though it be confirmed by the seeming want of motives for transgression. Inducements to crime may not, to the same extent, have been previously presented, and our incapability of discovering motives is no proof of their non-existence, as was established on the trial of Courvoisier, convicted for the murder of Lord William Russell. The non-existence of motives elicited the sympathy of many, it being contended by counsel that "the most trifling action of human life had its spring from some motive or other;" yet eventually proofs of his guilt and an abundance of motives were not wanting. How are cases of this nature to be distinguished from the operations of vice, otherwise than by a careful system of analysis:

I. Of those agents capable of affecting the personality: When the fact of an hereditary predisposition, the presence or absence of constitutional or organic irritation, the pre-existence of any particular disease, or the previous receipt of any injury, especially if the pre-existence of that disease or the receipt of that injury was capable of affecting the nervous system.

II. Of the relation between the intellectual and moral power: When the education, association, habits, and general moral exercises, as constituting the previous history, must, in their contrast with the special character of the particular acts to be investigated, determine the ability of the intelligence not only to perceive their culpability, but to prevent their commission.

The fourth class of cases, in which the moral feelings or affections appear as partially diseased, demands the closest application of those principles just quoted, as for their detection the employment of comparison is primarily important.

If we look at the broad face of creation, we on all sides recognize evidences of divine wisdom in the universal adaptation of the many units forming the whole, and perceive a beautiful harmony to pervade the operations of nature, proving that in the world external to man there is a certain conformity

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to a fixed standard; and leading us to the further inference that in the world internal to man equal ground for a similar opinion exists. The laws of nature are truths, however they may be misunderstood: our moral laws are equally as immutable, however corrupt the conscience may be. It is essential that similar harmony be regarded as indicative of the healthy, well-governed mind; for otherwise, many acts originating from a diseased condition might be attributed to a vicious disposition, and many vicious practices escape without punishment.

We have seen in our investigations respecting monomania that the evidence of unsoundness of mind in one may rest in opinions which in another would be perfectly inadequate to argue such a mental condition. In a similar manner a perversion or defective operation of the moral faculties may manifest itself by actions apparently consonant with soundness of mind and closely identical with the ordinary operations of vice. Dr. Rush observes: "There are persons who are moral to the highest degree as to certain duties, but who, nevertheless, live under the influence of some one vice. In one instance a woman was exemplary in her obedience to every command of the moral law except one. She could not refrain from stealing. What made this vice more remarkable was that she was in easy circumstances, and not addicted to extravagance in anything. Such was the propensity to this vice that when she could lay her hands on nothing more valuable, she would often at the table of a friend fill her pockets secretly with bread. She both confessed and lamented her crime." [38]

This particular manifestation of defective moral power, or kleptomania, as systematic writers have termed it, is universally admitted, and is at times advanced as a plea in extenuation of certain apparently criminal acts. It is not requisite to adduce examples. Their diagnosis rests on the recognition of this harmony we have premised. We enumerate the chief points of difference:

I. The criminal theft is the consummation of premeditated criminal desires. The insane acts, the result of a passing opportunity to gratify a morbid propensity.

II. The criminal acts accord to those of a generally vicious habit. The insane act opposes the ordinary individual exercises.

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III. The criminal act is accomplished for the ultimate advantage to be derived from the illegal possession. The insane act is unthought of beyond the pleasure experienced in its perfection.

IV. The criminal steals that which may be useful, and subsequently conceals his deeds. The insane act has no reference to ulterior advantages, and seeks not to guard against eventual discovery.

V. The criminal in his select robberies has his associates. The insane in their indiscriminate appropriations admit of no accomplices.

VI. The criminal will persist in the denial of his guilty practices. The lunatic, though anxious to conceal his present intentions, seeks not to disguise his previous success.

Another much more serious and fortunately a rarer form of this partial perversion of the moral sense is manifest in that disease which has been termed pyromania, whose chief feature consists in an irrational propensity to incendiary practices consequent on an insane love for conflagrations. Many writers have alluded to this particular affection, and offered various suggestions respecting its pathology, some attributing its existence to an insatiable desire for light, caused by venous repletion, and others associating it with certain post-mortem appearances which indicate the base of the brain as that part of the cerebral structure which is more immediately implicated. This is an affection which must be studied on the same principle as that just described. As an isolated form of disease it is happily of rare occurrence, which is proved by the fact that lunatic asylums so seldom suffer from fire, though as an accompaniment to or result of other more general mental disorders, it is occasionally met with. In the case of Martin, the burning of the cathedral was the consummation of his delusive suggestions, a secondary, not primary, morbid manifestation.

To distinguish such a morbid action from the ordinary operation of the incendiary demands a knowledge of the individual habits, position, and relation to any motives conducing to the act; the investigation of all circumstances previous and subsequent to its commission. The latter are of especial importance; for when the insane act is being accomplished, the pyromanist manifests such monomaniacal enjoyment of the

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scene as leads him to witness the success of his efforts; while the criminal speedily betakes himself to flight, and endeavors to conceal his participation in the transaction. In what respect responsibility attaches itself to acts of this nature, and to what extent the corrective discipline of asylums for lunatics with a criminal disposition might tend to their prevention, must be determined by the individual merits of each case. There is every reason to infer that the mind adequate to premeditate and perfect the accomplishment of such acts might be rendered the more capable of resisting those impulses which lead to their commission.

Other forms of partial moral manla are to be met with, involved in greater difficulty for their detection than those just described, inasmuch as their manifestations coincide with the ordinary operations of vice. Erotic mania may be ranged under this class. In this form of disease, not only may the nature and relations of the insane criminal act be fully understood, but the general intelligence conduce to its accomplishment. An idea which many writers with little philosophy and less observation formerly promulgated is now exploded—continence is no longer considered as a state of violence to nature. That a cultivated understanding and a vigorous mind will seldom suffer much from such a cause, observation of life establishes, in the persons of many whose vocation places them above suspicion. Such an affirmation, put forward as a general principle, must not be regarded as being intended to propound a positive rule. It is a physiological fact that the most powerful of all physical influences is that which the sexual function is capable of exercising on the intelligence. This is illustrated by the changes in disposition and thought attendant on the development of puberty, as well as by the mental declension which is usually observed to follow on the abuse or undue excitement of the generative functions. Mind and body thus mutually influence and react on each other. Education, reflection, habitual self-control, can so school the passions and subdue the emotions that, pending physical health, a perfect mastery is acquired over each somatic suggestion. A man may thus pass through life experiencing desires which he successfully subdues, when supported by principles adequate to do so. These desires, from their continued negation, are eventually placed in such complete abeyance that they may be

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said to have scarce an existence. When, however, from any cause the healthy relation between the material and immaterial constitution becomes interrupted, as it frequently does in advanced life, certain phenomena may be observed in some instances to ensue. Resulting from the presence of local or general irritation acting specially on the sexual apparatus, the nervous sympathies connected therewith become to a corresponding degree aroused, and in the ratio that they are so, capable of attracting the attention to their excited condition. As the attention becomes engaged the local irritation increases. Unless suitable remedies be applied, on the increase of the local irritation follows a morbid excitement of functions adequate to resist the effort of the will for their control. The animal nature increases in power, while the intelligence is at the same time rendered less capable of resisting its morbid emotions, which have so far attained a double force, from the actual strength imparted by the local disease and the relative strength consequent on the diminished powers of the will. It is not difficult to admit that, as such a state advances, the consciousness of guilty desire may coexist with an incapability for its resistance; and that thus men whose previous lives were opposed to vicious practices become morbidly attracted to the commission of crimes that compromise an unblemished character and disgracefully terminate an honorable career. Prostatic disease has in this much to answer for. It may be asked, Should not a sense of religious duty and moral rectitude enable the person so afflicted to bear his suffering with resignation, and give him strength to oppose the progress of vicious desires? Surely daily attendance on the bed of sickness must satisfy the observer that such is the case. All, however, are not equally impressed with that religious sense which sheds its halo around creature woe. All are not so mentally constituted that they can bear up against the combined influence of physical excitement and mental debility. There is no more painful, no more melancholy form of insanity than this. Medical writings abound with instances in which the existence of local irritation, the presence of, it may be, previously undetected organic change, has satisfied impartial medical men that a blasted reputation, perhaps an untimely death, might have been prevented by the application of those remedies which medicine places within the reach of the least experienced of her votaries.

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In the medico-legal investigations which may arise on such cases, the physician has a most trying and responsible duty to fulfil. Unhappily, age is not always characterized by virtue, nor are years a guarantee for that which is right. When on criminal trials a plea of this affection is set up, it is frequently the presence or absence of organic disease, be it general or local, which decides the case. None but medical men are competent for investigations of this nature. Most fully do we respond to Dr. Holland's observation: "Scarcely can we name a morbid affection of the body in which some feeling or function of the mind is not concurrently engaged. No physician can rightly fulfil his duties without an adequate knowledge of and constant regard to those important relations."

This grave question is at length receiving due attention. On the motion of Mr. Brudenell Carter, F.R.C.S., C.C., of great experience on the questions to be considered, a committee was appointed "to inquire into and report to the council upon the advantages which might be expected from the establishment, as a complement to the existing asylum system, of a hospital, with a visiting medical staff, for the study and curative treatment of insanity." Sir James Crichton Brown lent the weight of his high authority to the movement, on medical as well as economical grounds. The opinions of experts and specialists were taken and the result thus declared by the committee:

"That, in the opinion of the most experienced members of the medical profession, the knowledge which is professed with regard to the nature, prevention, and cure of diseased changes which underlie and occasion insanity is not commensurate with that which is professed with regard to diseased changes of other kinds, even those which affect other portions and other functions of the nervous system."

The committee further expressed their belief that the establishment of such a hospital as they recommend "could scarcely fail to be productive of increased knowledge of the subject of insanity, and, consequently, of increased means of prevention and cure." [39]

All honor to such public benefactors—pioneers in so good a cause!

The subject of moral insanity is one of almost infinite complexity. In the relative and mutual restraint the moral feelings exercise one on the other, and the capability the intelli-

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gence possesses of directing the whole, the character of an individual rests. To analyze the power of each passion or emotion and to estimate the influence they possess would require the scrutiny of a single character for a long life. To subdue and regulate the passions is the end of religion: to enable the intelligence to do so should be the object of education. In our study of this disease we cannot reject somatic influences, however obscure their operation be. In them we view but the offspring of transgression, which, though it imparted to man the knowledge of good and evil, by no means assured him his Creator intended he should have a full and satisfactory knowledge of his moral government of the world, or a capacity for resistance proportionate to his knowledge of evil.

In the practical application of this inquiry we must be prepared for the meeting with many cases full of doubt, which our best and most anxious investigations may fail to elucidate. Under such circumstances to complain of any difficulty or seeming contradiction is only to complain that human intelligence cannot pass those bounds which the wisdom of the Creator has ordained; and though it may thus happen that at times the innocent suffer, we will indulge just grounds for hope that such examples must be rare indeed; and, on the other hand, should mercy incline the scale of justice and crime revel in the success of ill-deeds, we have both divine assurance and human observation to attest that "seldom hath punishment, though lame of foot, failed to overtake a villain."

These remarks may be terminated by the following conclusions, deducible from the previous observations:

I. By the term moral insanity we express mental unsoundness, chiefly evidenced through the moral or affective faculty.

II. Though the moral and intellectual faculties appear to be, in their abstract exercises, capable of independent action, yet in their affective operations they mutually blend together and co-operate.

III. Analogous differences are observable in the development of the moral as of the intellectual faculties.

IV. Those differences are such as seem to impart a special character or disposition to each.

V. The intelligence is, in the healthy, properly-regulated mind, capable of controlling and directing the moral exercises.

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VI. The moral or affective faculty, being closely associated with the sensational, is therefore in nearer relation to the personality.

VII. Diseases affecting the personality may occasion morbid changes in the moral disposition without immediately involving the intelligence.

VIII. From the intimate blending, intricate co-operation, and mutual dependency of the separate mental faculties, causes producing abnormal action in the one usually eventuate in derangement of the other.

IX. Though in derangements of the mind the moral faculty appears primarily and solely involved, in many instances the non-development of intellectual unsoundness through other manifestations cannot be received as proof of its non-existence.

X. The sense of moral perception is found to vary according to the nature and extent of the guidance it may have received.

XI. The moral faculty, though incapable of determining positive duties, is adequate to oppose intellectual suggestions in such exercises as more immediately involve the moral perceptions.

XII. A want of accordance between the moral and intellectual faculties may proceed from either undue excitement of the moral or inefficient exercise of the mental powers.

XIII. Those causes adequate to affect either faculty must be carefully sought for previous to offering an opinion.

XIV. That as those are causes of a physiological, pathological, and strictly medical nature, irrespective of their ethical, logical, or legal relations, their proper estimation requires such a combination of knowledge as none other than a psychopathic physician could be reasonably expected to possess.

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CHAPTER IV.

IMPULSIVE INSANITY.

In the study of those insane states in which neither the moral nor intellectual faculty is, of necessity, inadequate to appreciate the relations of a particular act whose commission is alone to be accounted for through the admission of an irresistible insane impulse, we are led to inquiries of even greater complexity than those which have previously occupied us. The investigation is one that demands on the part of the psychologist a mind free and unbiassed, prepared to receive the mysterious realities of nature as truths, and to reason on those realities. In no form of disease is it more essential that the physician be endued with that which, for want of a better term, we designate as medical faith, or just confidence, the insensible growth of experience. This alone can regulate the judgment under circumstances when the ordinary principles of medical science seem to be shaken to their very foundation.

Like many other diseases, this particular affection may manifest itself through phenomena at once proclamatory of its true nature, or become so engrafted on pre-existing affections that its entity is lost in the lesion with which it is associated. To hope that, under such circumstances, truth will not be beset with many difficulties, is to assume a pre-established uniformity for the various actions to be adjudicated on; which assumption, however essential for and verified in the exact sciences, is, nevertheless, but little warranted when considerations embrace the varying phenomena of life. We venture, therefore, on the apparently paradoxical assertion that the greatest danger of modern medicine seems to rest in its miscalled rationality—that is to say, in the growing tendency to require demonstrative proof of the modus operandi of physical changes, as well as of psychical actions; forgetful that the first are not infrequently beyond reach, while the second,

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however intimately, or, as the highest authorities would lead us to believe, however invariably, they may be connected with special organic conditions, still present in their abnormal operations such strange diversity as must ever render their diagnosis and treatment the peculiar province of the experienced physician. We believe that, by thus confessing the obscurity and difficulty of many psychical investigations, we in no wise detract from the value of that knowledge physicians possess, but rather advance the scientific status of medicine in admitting its practice to be essentially dependent on the study of analogies; and further, by proclaiming that arguments cannot be reliable when the principles they would maintain are untrue, place such theory as is derivable from the collateral sciences in its proper position as an aid for the explanation of facts rather than the foundation on which they rest.

Differing altogether from either of those forms of disease we have been considering, and yet involving many of the prominent features of each, the diagnosis of impulsive insanity may be stated to rest in the application of principles already set forth as regulating opinions for their separate recognition. Thus it will occur that in a particular case the proof of this affection, as indicated in the act to be investigated, accords to the operations of criminal desire; while the mental habitude of the accused favors the opinion that from such it had originated. Again, it may happen that a mind whose previous exercises afford no clue to the mystery becomes amenable to this form of disease. In either of these instances the history of the case acquires separate value: in the one, involving the question in positive obscurity; in the other, investing its solution with a negative certainty. The fact is that in this particular manifestation of insanity, pending our inability to offer such explanations as may admit of proof, we take refuge in that asylum where vague doctrines, crude notions, and ingenious speculations find their resting-place, and with confidence appeal to the lessons of experience. Accordingly, in considering this as a peculiar affection, it is important that we define how it may be distinguished from those impulsive movements which result from monomaniacal conceptions, or those criminal acts which proceed from a morbid perversion or seemingly indicate a profligate acquiescence of the moral principle.

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With this object we proceed to reiterate some few of our previous remarks.

In our investigations respecting monomania we have seen that criminal acts may be the result of delusive conceptions, and that though the intelligence be adequate to recognize the civil and ethical relations of the act, yet, under the influence of the delusion, it may still find not only grounds for its justification, but be also fully competent to organize the means for its accomplishment: the diagnosis of such cases resting in the appreciation of the monomaniacal condition.

In our consideration of moral insanity we perceive that, consequent on the existence of that form of disease manifested chiefly through derangement or perversion of the affective faculties, a capital offence might be perpetrated whose commission, according with previous manifestations, should tend to identify insanity with vice: the diagnosis of such cases being full of difficulty, as demanding a close and careful analysis of those material and immaterial agencies directly or indirectly conducing to such an event.

"Reasoning madmen," whether the mind or morals be diseased, are always the most dangerous and difficult of the cases arising for adjudication. It seems preposterous to argue that deliberation and cunning adequate to devise and to await opportunity should not entail commensurate responsibility. Many humane men believe in the deterrent effects of capital punishment, and would in this class of cases desire the exaction of the extreme penalty, affirming that the general good demands so jealous a protection that the smaller infidelities of the mind should not prevail against the larger claims of public justice; adding that the mere fact that an impulse is not resisted is no proof that it is irresistible, and that punishments exercise a deterrent effect even on the insane mind. When thin partitions divide insanity from crime, if wrong be done it can only be by the verdict of a jury approved by a judge; the public safety, which includes that of the accused, is thus assured of a twofold protection.

The disease which we would now describe is one in which the act is impulsive, not uniformly complicated with mental delusion or moral perversion; except so far as may be manifest in its commission: one that the previous history affords no direct guide to, and the subsequent conduct is also inade-

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quate to explain; the morbid impulse neither of necessity originating nor terminating with the insane act. Winslow has afforded many examples culled from various authorities of this form of disease, of which the following may be regarded as types: "In 1805 a man was tried at Norwich for wounding his wife and cutting his child's throat. He had been known to tie himself with ropes for a week to prevent his doing mischief to others and to himself." "A man arrived upon the Pont Neuf, he rushed violently to the parapet and precipitated himself into the Seine He was seen by some of the bystanders, who drew him out of the water and saved his life. After some days of complete restoration, his friends asked him the reason of his strange conduct. He replied: 'I cannot give any account. I am in the happiest situation in the world. I have only to play with fortune and with men. I have never been ill. I do not know what troubles may come upon me. I can only recollect my arrival at the Pont Neuf and my recall to life.'"[40] Wherein rests the explanation of these cases? Ordinary principles fail to elucidate their essential nature. Are they not, therefore, the more instructive and valuable? Such illustrations of the secret workings of disease constitute so many landmarks in medicine; for admitting the truth that natural phenomena are alone explicable by natural processes, we are led to inquire how far our observation of many sensible operations enables us, in the absence of other data, to infer the nature of that process by which results of this character have been perfected.

It may be asked: Do we not thus recognize and confirm that absolutism in medicine to which our previous sentiments are opposed? We reply: By no means; since physicians, in regarding every psychopathic question as one presenting both psychical and physical relations, thereby recognize a diversity of agents as conducing to a similar result. It becomes an object of the greatest practical importance to determine, if not the actual, at least the relative value of those several agencies, the climax of whose operations is rendered manifest in insane impulsive acts.

In sound health, the direction of the motor powers is intimately associated with the regulation of the emotional agencies. Our actions being, under such circumstances, free and uncontrolled, we possess not only the capability of selecting, but

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also of adopting, any particular line of conduct; the moving power and the power moved being equally amenable to the direction of the will. We have described the will as "the ultimate decision which the moral and intellectual faculties conjointly determine." That the will does not wholly rest in the moral faculty is proved by the circumstance that we frequently act in opposition to our strongest inclinations. That it is not a simple intellectual result is demonstrated by the emotions experienced in our actions. The very fact of a will denotes, on the one hand, a capability of perception as requisite to establish a choice, and, on the other, the existence of criteria for the guidance of estimation, which presupposes our recognition of a moral scale. The will may, on such an assumption, be regarded as the expression of the psychical and ethical reactions; identified with neither sphere, yet resting in their relations and eventuating according as those relations may determine.

In the ordinary affairs of life the will rests in abeyance; for the moral and intellectual powers preserve such an equilibrium that our actions result without the necessity of its being aroused, the conduct being regulated by such a scale as the imperceptible reaction of the moral and intellectual faculty has afforded. When, however, circumstances arise which specially implicate either the moral or intellectual faculties, the will, as being identified with the individual habit, by insensibly directing the attention to one class of circumstances, so far diminishes the force or power of another, or, by practice, proves adequate to strengthen a peculiar associating principle to such a degree that it acquires a command over a particular class of ideas; but beyond this we cannot recognize its influence. To speak of the will as being instrumental in guiding the conduct when the mental operations are defective, is to ascribe a capability to an effect which we would thereby deny to a cause—a process of reasoning altogether fallacious; for except as the exponent of the animus, the will has no real existence. They, then, who would speak of an insane individual having his acts within the control of his will—using the term will in its true signification—and being therefore responsible, must regard the will as some extraneous production—a kind of *tertium quid*, factor as well as product—the responsible offspring, as well as agent, of the irresponsible mind. There

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are those who, entertaining such views, would argue a partial responsibility for the insane. This doctrine has been energetically condemned as being both false in theory and dangerous in practice; calculated to prevent any approximation to soundness in medical opinion, affording psychopathic problems for solution, in which both the elements of discussion—the criminal act and the unsoundness of mind—are thereby constituted indeterminate items from which it is in vain to seek a determinate result.

There is little doubt men are often led by vicious habits or the force of passion to act in such a manner as renders them the "creatures of impulse"—which we interpret slaves of an irregulated mind; when, for the time being, they are in a somewhat similar position to those driven to action by an insane stimulus. We must guard against confounding analogies with facts, nor for one moment identify that unsoundness of mind—or, to speak in terms less likely to be mistaken, that depravity of mind which results from vice—with that unsoundness of mind which we recognize as constituting insanity. But slender barriers may separate the two. In the former, the want of mental control has been voluntarily induced, and is capable of being aroused to a sense of what is right, being in truth but a submission to the evil promptings which beset humanity, whose discipline and guidance it is the object of religion to accomplish and of the laws to enforce: in the latter it is disease and not vice which triumphs. It is a self-evident proposition, that for the practical purposes of life all ethical or logical similitude between the two is lost the moment we pass beyond the particular act.

We are conscious that for the regulation of our conduct the mind carries on many intellectual processes, which, though leaving no direct traces in the memory, are not without exerting a material influence on the disposition, with which the will seems to be identified as the instinctive expression of such unconscious operations. These mental processes continue until some event occurs which interrupts the routine of their passive action, when it becomes a question as to whether the admitted obligations of acknowledged truth or the dictates of a depraved humanity gain the ascendency.

In the same mind, the consciousness of that which is right is not always adequate to insure its adoption, unless the mind

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be strengthened by motives which it places in successful opposition to the natural desires. In this inability is exemplified the natural condition of man: a fact involving a psychopathic problem which sacred and profane writers alike attest. "The good that I would, I do not; the evil that I would not, that I do," St. Paul exclaims when lamenting the weakness of his humanity. Cicero arrived at the conclusion of a perpetual internal conflict between right and wrong from philosophy alone. Ovid observes:

> "Sed trahit invitam nova vis; aliudque cupido
> Mens aliud suadet—video meliora, proboque,
> Deteriora sequor."

Araspas declares: "I plainly perceive that I have two souls; for if I had but one, it could not be at the same time both good and bad; it could not at once act both virtuously and viciously, or will at the same time to pursue and avoid the same conduct. But, having two souls, when the good one prevails I act virtuously, and when the bad one prevails I disgrace myself with vice." Were we in the healthy individual to recognize such mental conditions as sufficient exculpation for illegal acts on the grounds of their being involuntary, we should thereby afford full range to licentiousness and remove the necessity for that mental and moral cultivation which is the only effectual security against grossness or crime. To say that vice is involuntary because the dictates of conscience oppose its commission, while the depraved appetite triumphs in its accomplishment, or to presume that responsibility is lessened because men are conscious of the wrong they commit and lament their inability for resistance, is simply to afford full scope to the worst passions of our nature. That free agency is permitted to man and the capability of acting with a perfect sense of responsibility identified with the healthy condition of his mind and body, all must believe who would expect happiness here or hope for a future hereafter. When, then, we speak of crimes being the result of an insane impulse, we declare the individual perpetrating them to be an automatic instrument in which the will has been replaced by a morbid stimulus, the guidance of the mind being wanting for other appreciation of the act than such as is necessary for its accomplishment.

If these opinions be correct, we seek to explain the cause

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of the impotence of volition characteristic of the disease under consideration, by an analysis of the several agencies which observation points out as adequate for the production of phenomena similar to those observable in insane impulsive acts, and become the more convinced of the close and intimate reactions existing between the physical instrument of thought and the vital principle, and those active agencies of which it is the source.

That a very marked association exists between the emotional feelings and the motor powers, maintaining them in perpetual reaction, is abundantly proved by the fact that in extreme states of mental excitement, when the emotional feelings are those principally implicated, analogous physical manifestations, as convulsions, etc., not infrequently ensue; while in other constitutions, in which the psycho-physical sympathies are less acute, the emotional feelings, though not proceeding to the same extent, still find in violent physical exertions their greatest relief. In illustration of this we might adduce many familiar examples. When the mind is adequate to regulate the emotional feelings it may determine their external manifestations, and in order that it do so it is requisite that the agency of the will be exercised for their physical exposition or their repression. When, however, the mind is not adequate to such an end, a simultaneous accordance and development of psychical and physical phenomena ensue. The emotive faculties direct the motor power according as they are themselves attracted, and so impulsive actions result, in which the will has no part. The direction of the motor powers being dependent, in a great measure, on the regulation of the emotional agencies, demands that their harmonious co-adaption be preserved—that is to say, that the existence of pathological and metaphysical freedom be determined in those cases where the question of responsibility for impulsive acts comes to be investigated; when, should it appear that the healthy operation of either sphere is interrupted, the physician may, from his scrutiny, be enabled to estimate the influence such interruption is adequate to exercise on the conduct of the individual under examination.

The examples of this disease present two distinct forms:

1st. Cases in which the impulse exists, and the motor powers are *in initio* under control.

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2d. Cases in which, simultaneous with the impulse, is the accordance of the motor power.

While confessing our inability to offer any determinate pathological explanations for the elucidation of cases of this nature, we believe we are not without sufficient grounds to infer that sudden and apparently unaccountable outbreaks of insanity must be regarded as either the effects of mental reaction, in which an effort is made to relieve the mind of a cumulative morbid tendency, the consequence of chronic, deep-seated nervous disease, or that their occurrence is but the first indication of such cerebral changes as are the prelude to incurable and not infrequently fatal results. Winslow, many years ago, observed in reference to this point, when speaking of impulsive homicides: "If such cases were attentively examined, I believe that in every instance the murderous impulse would be found to have been preceded by a derangement of the bodily and mental health which has escaped observation." The truth of this statement is each day established, since insane impulsive acts will be generally found to derive their proximate origin from any cause capable of interrupting the seemingly healthy operation of what is subsequently admitted to be a diseased mind, or adequate to particularly attract the depraved attention: causes may rest either in a severe mental shock or some incidental occurrence, apparently unconnected with the morbid phenomena they so materially contribute, not to originate, but to develop, a feature in this particular form of disease that must be considered as characteristic.

Impulsive insanity, which might perhaps with some truth be regarded as being analogous to a psychical convulsion, has been found to present a close similitude to other affections of the nervous system, in which the physical structures are those more immediately implicated. Its uncertain and variable nature, its recurrent character, its tendency to arise from that which we may term psychical sympathy or imitative propensity, so fruitful a source of neurotic affections among those so predisposed, afford strong presumption of its nervous dependency. Its general physical predisposing causes are identical with those known to operate injuriously for the production of all mental disease. The special physical predisposing causes include hereditary transmission, the receipt of injuries, particularly of those affecting the cerebral structure, irritations

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at the great nervous centres, conditions of the system conducing more immediately to congestion of the vessels of the brain, as the chief and most frequent. Of the importance to be attached to the first of these physical causes, all writers agree. Our appreciation of the second must be guided by the nature and extent of the injuries rather than by the period which has elapsed since their receipt. The third entails an analysis of the psycho-physical sympathies. The practical value of the last, or cerebral congestion, as an element in the formation of diagnosis, is not infrequently lost, since we are, from observation generally, deprived of the means of forming an accurate opinion of the state of the circulation previous to the commission of the particular offence; and though the patient be seen immediately after, the physician cannot exclude the influence of that excitement attendant on or consequent to its perpetration. The knowledge that many who manifest a tendency to impulsive acts suffer at the period of their commission from cerebral congestion, while offering a valuable suggestion for the treatment of those known to be so affected, at the same time affords a pathological association which, when considered in combination with other elements for the guidance of opinion, becomes of the first significance. Damien, who attempted to assassinate Louis XV., persisted to the last in saying that had he been bled that morning, as he had wished, he would never have made the attempt.

Mrs. Brough, tried for the murder of her six children, in her statement of the facts adduced on her trial affirmed that immediately previous to the desperate act, while being mentally and physically depressed, "there was something like a cloud over her eyes;" that, intending to cut her own throat, she possessed herself of a razor for that purpose, when she experienced the impulse to also cut the throats of her children, to whom she had previously manifested a mother's kindness. Having detailed the manner by which their death was accomplished, she adds: "I then lay down and did myself. I can't tell you what occurred for some time after that, till I seemed weak and found myself on the floor. That nasty great black cloud was gone then."[41] Buranelli, for some days previous to the commission of the crime for which he was executed, suffered from pains in his head, and on the morning of the day in which the murder was committed complained of "an irre-

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sistible force pressing on him." In many points these last two cases present an analogy. In both of them the nature of the act itself afforded the strongest evidence of insanity. It would have been well for humanity and justice had that analogy been further sustained, and the medical protest signed in behalf of the latter received that consideration which the solemnity of the interests it involved and the high integrity as well as ability of those physicians whose opinions it represented ought to have insured.

Arthur O'Connor, tried on the 12th of April, 1872, for presenting a pistol at the queen and attempting to force upon Her Majesty a petition, combined in his person many of those conditions believed to predispose to this form of disease. He was a grandnephew of Fergus O'Connor, of Chartist notoriety, who had for months been an inmate of a lunatic asylum. He was of a scrofulous constitution, had a misshapen head and an irregular spine. One month previous to the offence he had received a severe blow, leaving a lacerated wound on his temple. He suffered from intense headache and sleeplessness. On the night before the public thanksgiving in St. Paul's for the recovery of the Prince of Wales—29th February—O'Connor endeavored to gain admission to the cathedral armed with a pistol and knife, for the purpose of compelling the queen to sign a paper purporting to give free pardon to certain political prisoners. Prevented in his attempt, he succeeded two days afterward in secreting himself in the entrance to Buckingham Palace; and getting close to the royal carriage with pistol in one hand and paper in the other, was arrested when apparently taking aim. Sir John Coleridge, Attorney-General, appeared at Central Criminal Court to prosecute. Medical treatment and prison regulation had restored the prisoner to apparent health. He pleaded guilty. Being under age, his family raised the question of his sanity and ability to plead. Evidence was given of his ordinary habits being quiet and unobtrusive, and that he was a youth well read and studious. Dr. Harrington Tuke stated the prisoner had informed him the idea suddenly entered his head to shoot the queen, and he determined to do so. With rare cunning he evaded detection, and, were his weapon loaded, certainly had opportunity to carry out his intention. He had, however, omitted that detail. Dr. Tuke regarded his case as the immediate develop-

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ment of hereditary disease, and one presenting a very dangerous form of "reasoning insanity," or the "folie raisonnée" of French writers. Prisoner stated, after the excitement of his arrest had subsided, "the scales had been removed from his eyes." Evidence of his ability to then plead was given, and the jury found for the crown. Baron Cleasby interpreted the expressions used by the prisoner to indicate a moral consciousness of wrong, their obvious meaning being that the cerebral congestion had passed away, and observed to the prisoner, "There is not the slightest doubt there is no insanity in you, if that expression was a genuine one." He sentenced him to twelve months' imprisonment with hard labor, and one whipping of twenty lashes with an instrument called a birch rod.[42] Having acted as counsel for the prisoner's family on this trial, I have since ascertained he was not whipped, neither was he detained in prison, but, with government help and aid of friends, proceeded to Australia. From that country at the end of the year he unexpectedly returned, and was found under somewhat similar circumstances concealed in Buckingham Palace, and, without renewed publicity, placed in a lunatic asylum. Dr. Tuke was my informant of these details.

These examples of the influence of cerebral congestion find their further corroboration in the fact that many most determined suicides have, as soon as the depletion from their self-inflicted wounds reduced their circulation, not only manifested the greatest anxiety for life, but on their recovery have been perfectly cured of that morbid tendency which had rendered their tenure of existence alike miserable and uncertain.

Failing, however, in this, as in other forms of mental disease, to establish any fixed pathological relations, yet acknowledging the importance of all physical associations, we are led to the closer investigation of those other circumstances which, in the estimate of any particular impulsive act, should influence our opinion. These considerations may be conveniently ranged under two heads:

1. Those having relation to the individual accused.

2. Those relating to the special character of the criminal act.

Under the first head, all that refers to the personality must receive the closest psychical scrutiny, when, in addition

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to special points mentioned as demanding investigation, every physical derangement becomes an important element in diagnosis whose value is proportionate to the influence experience affirms it may be capable of exercising. But some one exclaims, "So many individual differences exist, both in the physical and mental constitution, that the result of their reactions varies in each particular case." We have premised this, and declared that it is only by bearing in mind what those laws are which operate in the production of phenomena, and by weighing the possible modifications they are adequate to mutually exercise, that anything like accuracy in opinion can be approximated.

It becomes a duty to investigate the different circumstances which influence the relation of these laws. By reflecting on the nature of agencies which have proved adequate to the production of known phenomena, we are, from either the presence or absence of these agencies, furnished in any particular case with a certain amount of positive or negative information. It will be at once admitted that causes capable of producing extreme results in one constitution are apparently harmless in their operations on another. Gastro-intestinal irritation will, for instance, in one individual give rise to the severest form of convulsion, and a terrible train of anomalous symptoms ensue; while in another its presence is only marked by the local inconvenience thereby occasioned. Though the conjunction of events must be considered as apart from their connection, yet when they stand apparently in the light of cause and effect, we become impressed with the necessity of inquiring into the reason of such a difference between individuals exposed to the same influences, and are led to an estimate of those physical sympathies which are in some adequate to place the whole system at the mercy of a single point of irritation. It is found that in such the local excitement prevails, because the constitution is adapted for the same; and that the constitution appears to be adapted, because the local excitement has prevailed. Causes, acting and being acted upon, move as it were in a circle, the centre round which they revolve being the source from which the irritation present had primarily originated; the secret predisposition resting in some physical specialty, either congenital or superinduced. This individual aptitude for and uncertainty in the eventuation of

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disease is also illustrated in mental affections. The latter is equally without a rule by which to connect psychical and physical operations, or associate general psychical conditions as the necessary accompaniment of any abstract physical phenomenon. If we look further for analogies which would lead us to infer so close a similitude as to almost argue a connection between this form of insanity and other lesions in which the nervous system is principally engaged, we have them amply supplied in the fact that psychical sympathy or imitative propensity is one of the most fruitful sources to which insane impulsive acts are to be attributed.

In his paper read before the Académie de Médecine, 2d May, 1848, M. Belhome offers many valuable remarks in reference to the particular effect of political emotions as productive of partial mental derangements. As we review the events which in that year revolutionized the Continent and extended their influence to our very hearths, we are led to believe that many of those changes resulted from the widely-extended operation of psychical sympathy—that as, in physical expositions of nervous derangements, imitative propensity originates similar affections in those in whom the predisposition exists, so in an analogous manner the psychical operations follow a similar course when a morbid sympathy permeates the masses, among whom many are to be found keenly susceptible of its particular influence. The study of the great French Revolution must ever remain, for the psychologist, an era of surpassing interest. Of the events which then occurred we may observe, as Hecker did when speaking of the epidemics of the middle ages: "They are a portion of history, and will never return in the form in which they are there recorded; but they expose a vulnerable part of man—the instinct of imitation."

We desire not to quote history further than it affords illustration. For this reason alone is it permissible to draw aside that veil of oblivion in which time has vainly sought to envelop the then events, too terrible for recital in detail. It is enough to adopt the words of Carlyle: "Whatsoever is cruel in the panic-frenzy of twenty-five million men, whatsoever is great in the simultaneous death-defiance of twenty-five million men, stand in abrupt contrast near by one another; unarmed truly, and undrilled, but desperate in the strength of frenzy." This is a true psychical record of the situation, nor is the ex-

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planation less accurate. "Very frightful it is when a nation, rending asunder its constitution and regulations which have grown dead cerements for it, becomes transcendental, and must now seek its wild way through the new chaotic—where Force is not yet distinguished into Bidden and Forbidden, but Crime and Virtue welter unseparated in that domain of what is called the Passions: of what we call the Miracles and the Portents." Surely M. Belhome could not better this description of a time when "pity lost in rage and fear" witnessed thousands of innocent lives sacrificed to the wild justice of revenge at the hands of a nation in the delirium of revolution revelling in a Saturnalia of blood. "History," adds the illustrious sage, "tells us many things, but for the last thousand years and more what things has she told us of a sort like this?" And yet the revolutionary era was not without many examples which may be appealed to as standing in bold contrast to its grosser parts. The humblest of artisans vied with leaders of the aristocrats in teaching their assassins how to meet death without fear. The most gifted of both sexes suffered, and were strong. Those distinguished in art, science, philosophy, and law were intermingled with the most debased in one common massacre. Cultured progress and civilization being for the time effaced, the French capital, if not the French nation, appeared to be remitted to primitive barbarism. "The ambient atmosphere of transcendentalism and delirium" extended from Paris to important cities that joined in the mad debauch. The Carmagnole, in its "rude whirl-blasts of rags," affording to the sans-culottes opportunity for savage rejoicing at indiscriminate slaughter offered to that "sharp female called La Guillotine," whose thirst did not abate until she drank the blood of the very miscreants who had called her into life. The number of victims was counted by thousands. In the first three months of 1794 they reached 281. In May, 324 were executed; in June, 672; in July, 895, without reckoning Robespierre and his party executed at the end of that month. As many as 67 perished in one day, 7th of July.[43] If anything could add to the horror, it is the following quotation: "At Meudon," says Montgaillad, "there was a tannery of human skins, such of the guillotined as seemed worth flaying, of which perfectly good wash-leather was made for breeches and other uses."[44] The writer whose figures have been quoted and

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whose statesmanship gives weight to his admonition—Lord Brougham—speaking from his deep study of the events, fortified by personal conversation with many of those most active in their attempted direction, cautions us "not to permit prejudices to warp our opinions or arrest the judgment required by the interests of truth and justice," and adds: "It would be equally contrary to both were we to exclude from our consideration the extenuating tendency of the undeniable fact that all men in those times were more or less under the influence of the temporary delirium which rendered them alike insensible to their own sufferings, blind to their own perils, neglectful of their duties, and regardless of other men's rights."

The political significance and teaching of such events appertain not to the object of this work. They are written in red letters, a warning alike to rulers and to ruled.

It would not, narrowing our sphere of inquiry, be difficult to enumerate many examples where the ordinary phenomena of existing disease have been strangely modified in obedience to the involuntary operation of sympathy; as also where, without other assignable cause, certain affections have been developed in individuals who, though possessing a constitutional aptitude, had not, until this latent sympathy was aroused, displayed any particular morbid manifestations; and who, were it not for the kindling of the latent spark, might have gone through life without being conscious themselves, or manifesting to the world the existence, much less danger, of that mine of insanity thereby sprung. Physical sympathy we know to be proportionate to nervous communication or nervous supply, and to be, moreover, to a great degree dependent on the general tone of the physical constitution. With this, psychical sympathy or imitative propensity preserves an analogy, since observation establishes that it is most liable to be aroused in those whose physical structure bespeaks high-wrought sensitiveness, and whose psychical receptivity appears equally open to impressions from without. Man in a state of health has been aptly described as an imitative animal. In diseases of the nervous structures more particularly this natural disposition becomes morbidly increased, and many deeds which his unclouded judgment would reject become acts of necessity, against which all his struggles are in vain. This insane adoption of particular habits must be distinguished from that which

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in the healthy mind results from continued association: the one proceeding from a morbid and determinate assimilation of conduct—the other denoting an insensible accordance of sentiment; the one implying the assumption of a particular habit irrespective of principles—the other the adoption of such habits from the acquiescence with their principles. There is, then, in the recognition of this physical and psychical action and reaction, a further element for the formation of diagnosis, which, it will appear, is equally valuable both in its application to the individual, as well as to the act under investigation: to the individual, as entailing the analysis of his nervous constitution—to the special character of the act; as leading the physician to estimate the relation it may bear to any circumstances, however remote, which experience assures him are adequate, through those sympathetic laws, for its development, if not its generation.

That extraordinary states of mental excitement may be, to a remarkable degree, dependent on some single physical nervous derangement adequate to present illusions to the predisposed mind, is particularly illustrated in hypochondriacal disease. In proof that the influence of local causes seems to be, in many cases, mainly instrumental in the production of psychical phenomena, we quote Esquirol's observation: "Reil relates that an insane lady having fits of excitement, and even of frenzy, her maid wishing one day to quiet her, put her hands over her eyes, when the patient immediately recovered herself, was perfectly calm, and declared that she no longer saw anything. The medical attendant, informed of this phenomenon, tried the experiment himself, and was convinced that her agitation was produced by the disorder of her eyes, which represented terrific objects to her."[45] Baron Larrey mentions the particulars of a patient recovering from amaurosis, to whom all objects appeared of unnatural magnitude. Many other similar instances are on record.

In our estimate of causes of such a nature, while admitting the fact of the local organic change rendering the nervous apparatus a defective or erroneous messenger, we are still led to investigate the condition of the mind, which is inadequate to correct erroneous impressions thereby received, and permits apparently trifling lesions to prove sufficient for the destruction of the balance of power, thereby shown to be in many

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minds suspended by the feeblest threads. Yet as the least experienced will call to recollection ample facts to satisfy them that such local deviations from normal action are but secondary links in the chain of morbid phenomena, it is best to pass to those more particular, but not less practical, considerations which relate to the special character of the criminal acts.

The first form of this disease includes those cases in which the impulse exists, and the motor powers are *in initio* under control.

Medical writings abound with illustrations of this form of disease, of which M. Marc has in particular afforded many well-marked examples. The cases he has adduced have already been quoted by so many authorities, more particularly that which occurred in the family of M. le Baron Humboldt, that it is scarcely requisite to do more than now refer to them. A female servant, while daily undressing a little child, was at such times, from the whiteness of its skin, seized with the desire to tear it to pieces. Restraining her impulses, she threw herself at the feet of her mistress, against whom she had no complaint, and entreated that she might be sent out of the house. Another instance may be adduced from the same author. A young lady in an asylum, rational on every subject, experienced a violent inclination to commit homicide, for which she could not assign any motive. Whenever she felt the approach of the fit she entreated to have the strait waistcoat put on.[46] Dr. Zimmerman relates the case of a peasant, born at Krumback, who was often seized with an irresistible impulse to commit murder. He felt the attack coming on for hours; sometimes for a whole day. As soon as this presentiment of its approach was experienced, he begged to be secured and chained, that he might not commit some dreadful crime. "When the fit comes on," he says, "I feel under the necessity to kill, even were it a child." He declared that his parent, whom he loved tenderly, would be the first victim to this murderous propensity. "My mother," he cried out with a frightful voice, "save yourself or I must kill you." Before the fit he complains of being exceedingly sleepy, without being able to sleep. He feels depressed and experiences slight twitchings in the limbs; he preserved his consciousness during the fit, and was conscious that in committing murder he would be guilty of a most atrocious crime. When he is disabled from

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doing injury he makes the most frightful contortions and grimaces, singing or talking in rhyme. The fits last from one to two days; when they are over he cries out: "Now unbind me. Alas! I have suffered cruelly, but I rejoice that I have killed nobody."[47]

Another example may be briefly quoted. A gentleman called by himself at a lunatic asylum and begged for admission, at the same time presenting a note from his solicitor, whom he had just left. This note confirmed his own account that he required restraint, for, as he stated, "he had an irresistible desire to murder his wife or one of his children." He continued: "That the preceding day he was walking in his garden, when he saw his wife and little girl approaching toward him. His eyes at the same moment caught the sight of a hatchet lying on the gravel walk, and he described that he had the greatest struggle within himself to escape out of the garden before he seized it, to strike, perhaps fatally, one or other of them." He loved his wife and child, he affirmed, dearly, but the homicidal idea haunted him continually, and he felt that he could not trust himself alone in their presence. It should be added that the last time he slept at home he did attempt, in the middle of the night, to strangle his wife, and would have succeeded had not her cries in the struggle brought in timely assistance. In the midst of all this, during the explanation he gave of his case, he expressed himself well and rationally. His intellect appeared to be unclouded, and it turned out that he was at the same time in communication with his solicitor respecting some proceedings in the Court of Chancery, upon which he gave perfectly sane instructions.[48]

The list of cases might be extended without difficulty. Sufficient has been adduced to establish the nature of this particular form of impulsive disease, the proximate cause of which appears to depend on any circumstance adequate to specially attract the predisposed mind, more particularly if such cause is of a nature capable of associating with the depraved intelligence the motor powers. Thus in one case the proximate cause rested in the object of homicidal intent; while in the other the predisposition had no fixed attraction. Again, the predisposition is directed toward the objects by which the general thoughts are chiefly occupied, its active exercise being dependent on incidental occurrences. In the last-mentioned

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case the morbid predisposition was at once roused into action by the sight of a weapon capable of forming a link between the insane impulse and motor powers.

The period of life at which this impulse to destroy has been observed to occur, and the length of time during which it has been known to continue, afford additional evidence of its being a special form of disease. Esquirol relates the case of a young girl, eight years of age, who manifested a determination to kill her stepmother. In the case of John Glenadel the desire for murder existed for the space of twenty-six years. In all these cases a consciousness of wrong in the act and an incapacity for its avoidance were fully experienced.

The second form of the disease—that in which, simultaneous with the impulse, is the accordance of the motor power.

William Brown was executed at Maidstone, England, in 1812, for strangling a child whom he accidentally met one morning while walking in the country. On the trial he said he had never seen the child before, had no malice against it, and could assign no motive for the dreadful act. He took up the body and laid it down on some steps, and then went and told what he had done, requesting to be taken into custody. He bore an exemplary character, and had never been suspected of being insane.[49] A young man in perfect health awoke suddenly one night in a fit of raving madness, ill-treated his wife, attempted to leap out of the window, and struck at whatever came in his way. An emetic put an end to this scene in an hour, since which he has been in a perfect state of health, never having had a recurrence of the attack.[50] It is related of Mathews, the comedian, that having for some days led a vapid and inactive life, he joined a party of pleasure. "He had not ridden out of the city for some weeks, and was in a state of childish delight and excitement. At this moment his eyes turned upon one of the party, a very little man, who was perched on a very tall horse, and who seemed unusually grave and important. Mr. Mathews looked at him for a moment, and the next knocked him off with a smart blow, felling him to the ground. The whole party were struck with horror, but no one felt more shocked than he who had committed the outrage. He dismounted, picked up the little victim of his unaccountable freak, declared himself unable to give any motive for the action, but that it was an impulse he could not resist;

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and afterward, in relating the extraordinary incident, he declared that it was done in a moment of frenzy, induced by the too sudden reaction from previous stagnation of all freedom and amusement."[61] Many examples of this nature might be adduced confirmatory of Esquirol's opinion that "there exists a species of homicidal madness in which no disorder of the intellect can be discovered." In the cases last mentioned, the previous history is only of negative value; the character of the acts alone affording grounds for our opinion. Were this disease to remain thus simple and uncomplicated, its diagnosis would present sufficient negative grounds to invest it with an almost positive certainty—the known character of the accused, the abstract atrocity of the act, the circumstances preceding its commission and following on its consummation, rendering its investigation a matter in which a careful estimate of natural laws is that chiefly required. Inasmuch, however, as actions closely identical with these impulsive movements may arise as the result of vicious conditions of mind, which accord in their character to morbid operations, their diagnosis is not infrequently involved in considerable difficulty.

In our considerations respecting moral insanity it was found in the form of disease manifested by a general derangement of the moral principle, there was a remarkable and close analogy between its operations and those of vice. The details of many cases prove that homicidal acts have resulted from mental conditions, in which the singular accordance of morbid phenomena with the ordinary operations of crime was well calculated to confound those who would attempt to form a judgment without instituting a most careful analysis. In an example related by Pinel, the habitual indulgence of evil passions was accompanied by a disregard of animal life, and such an uncontrollable career of vice as led to the commission of murder. Dr. Prichard has enumerated many cases in which homicidal and moral insanity were intimately associated. Thus: Antoine Leger, whose previous history established insanity, "seeing one day a little girl near the margin of the wood, he seized her, murdered her, sucked her blood, and afterward buried her body. He was, we regret for the sake of medical science, sentenced to death. MM. Esquirol and Gall examined his head. The former discovered morbid adhesions of the pia mater to the brain. M. Gorget, after examining

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the facts, justly concluded an asylum, rather than a gibbet, should have been the sick man's award."[52] To this we may add the case of Feldtmann, "who, after attempting to gratify an incestuous passion for his own daughter, who had invoked the aid of the police to resist his attacks, stabbed her to the heart, wounded his wife and another daughter, and then gave himself up to a crowd who surrounded him, exclaiming, in reply to their reproaches, 'C'est bien fait.'" This unhappy being was also executed. The existence of insanity was not fully established by facts; but it seemed evident that the miserable wretch, who suffered for his offence, had scarcely intellect enough to comprehend its nature and to perceive the turpitude of his conduct, though he foresaw the destiny which awaited him. M. Breschet considered his brain to be in a condition different from that of health; and M. Gorget's opinion was that "Feldtmann was a man whose weak intellect was overwhelmed by a passion constituting in itself a real disease, which ought to have been cured by separating the unfortunate wretch from society, without resorting to the barbarous expedient of extinguishing it together with his life."[53] In the case of Anthony Emmanuel Joberd we find, superadded to perversion of the moral feelings, the homicidal mania, accompanied in one instance by the capability of control consequent on the contending force of passion; and the impulse yielded to in the second, where a perfect stranger, altogether indifferent to the accused, was the victim.[54]

We have deemed it the more advisable course to refer to well-known instances of this disease, rather than to adduce examples whose details, though less familiar, would still present no better illustration of the phenomena we seek to elucidate.

Cases of this nature constitute not infrequently occasion when the physician is called upon to affirm the godlike function of the healing art, which, for the tempering of justice with mercy, declares that the operations of disease, whether they render the body a disfigured mass of loathsome matter or pervert the mind till it becomes a depraved instrument for revolting conceptions, are still fitting objects for commiseration and care, rather than abhorrence or vengeance.

We have affirmed that simple and uncomplicated examples of disease offer to the experienced physician but little difficulty

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in their recognition; the truth, however, is that uncomplicated lesions are the exceptional cases. It is for the estimate of morbid combinations that the medical mind becomes essential. Thus homicidal insanity or impulsive mania, associated with the desire to destroy life, may arise pending another and distinct form of disease, of which it is not impossible it forms the most prominent feature. The one affection becomes engrafted on the other, and the same mistake occurs as is common in physical disease—the symptoms which appertain to one are considered as characteristic of the other, and their differential diagnosis is thus lost sight of. It is not difficult, with the foreknowledge that an individual has suffered from unsoundness of mind, to estimate at its true value the homicidal act. It may be also an easy matter to recognize the process by which an admitted monomaniac has become a homicide; but cases occur in which, for such a purpose, every conceivable obstacle exists; in which the homicidal act has seemingly no connection with the delusion, as in the instance of the youth and the windmills; or again, where the monomaniacal condition is so concealed that the homicidal act, long contemplated and deliberately executed, is in itself the first prominent indication of the mental unsoundness. Thus a man of the name of Frost was tried for killing four children at Norwich; his idea was that he thereby obtained for them an early translation into heaven, and sent them all there.[55] Instances of this nature differ materially from the true form of the disease we are describing; for in such, strong motives for the deed, however insane, exist in the mind of the patient, against which they may have long struggled secretly, until at length, from the delusive nature of the morbid conception, they are led to regard the commission of the act, which they had previously abhorred, as the highest evidence of their moral excellence. In such examples impulse, it is true, exists; it is, however, a phenomenon engendered by, not originating with, a mental condition. We have alluded to the influence which psychical sympathy is capable of exercising on the masses, and have inferred that this form of insanity presents a remarkable analogy to other diseases involving the nervous system. On this point Winslow writes: "The commission of a great and extraordinary crime produces not infrequently the mania of imitation in the district in which it has happened.

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A criminal was executed at Paris not many years ago for murder. A few weeks after another murder was perpetrated; and when the young man was asked to assign a reason for taking away the life of a fellow-creature, he replied that he was not instigated by any feeling of malice, but after having witnessed the execution, he felt a desire, over which he had no control, to commit a similar crime, and he had no rest until he had satisfied his feelings." Gall has recorded the instance of a man who, on reading in the newspapers the particulars of a case of murder perpetrated under circumstances of peculiar atrocity, was instantly seized with a desire to murder his servant, and would have done so had he not given his intended victim timely warning to escape.

In those individuals in whom a latent predisposition to this disease exists, extraordinary mental emotions are known to be capable of acting as the proximate cause of its development. Pinel relates a case of impulsive insanity consequent on the excitement of seeing armed men. Similar examples might be quoted, as also other instances, in which, when so excited, the mere sight of a fitting weapon has been sufficient to determine the execution of the extreme act. It would be a matter of mere industry to extend the number of such illustrations; we forbear to do so, believing that if those we have advanced prove insufficient, others would not render us more certain.

In the investigation of cases of this nature the physician requires to stand fast by the principles of philosophic medicine, that he be enabled, as far as human means avail, to aid justice by, on the one hand, protecting the victim of popular hatred; or, on the other, exposing the pretender who should seek to screen his infamy under the mask of infirmity. Who, on reading of the execution of many of those wretched insane, but feels thankful that we now live in an age when science, dissipating the gloom of ignorance and superstition, has divested psychology of other difficulties than those which are inseparable from all sickness, as being involved in the great mystery of our being?

Here it is that the psychologist requires to concentrate the several elements which contribute toward his diagnosis. All that relates to the personality of the accused; the estimate of his mental constitution, both in its moral and intellectual

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operation; the character of the act in its twofold relations to his intelligence—constitute the three sources in which the grounds of his opinion rest. We impress the necessity of carefully estimating the psychical as well as ethical relations of the act. While the law recognizes the act, it is still determined by the motives which may have induced its commission. Such being the case, the presence or absence of presumed motives to the crime becomes of the greatest importance—the existence of these motives being determined by the evidence, their psychical value resting with the physician. We impress this latter point, for were the truths of medical science to be regarded as being dependent on the imperfect machinery of the law, we should have the appreciation of each act varying not only according to the number of motives wanting or adduced, but also proportionately to the significance of those motives in the mind of the separate members of a jury. It is well that the sources of error, as regards motives, be fully understood. In one instance the presumed absence of motives may proceed from our inability to detect them; while in another, the only motives adduced are of a character altogether disproportionate to the magnitude of the crime. Thus, in the year 1826, a young girl was condemned for life to the public works for having in cold blood cut off the head of a child belonging to one of her neighbors. In the absence, says the "Gazette des Tribunaux," of all known interest in the commission of the crime, the medical men declared that the mental condition of the accused presented unequivocal symptoms of mental alienation. The real facts were revenge for the father of the child having deceived her in love.[56] The record of crimes in England affords similar illustrations. In July, 1837, a man of the name of Greensmith was tried for the murder of four of his young children. He was proved to have been a man of industrious habits; he got into distress and destroyed his children to prevent them being turned into the street; there were no other motives. He was found guilty and was subsequently declared to be insane.[57] Here, in one instance, we have motives concealed; in the other, motives indicative of insanity.

How many men may, with the greatest deliberation, commit crime, but, owing to circumstances, be mistaken in their victim, and a homicide be perpetrated where no motives

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having reference to the individual suffering can be detected. Again, the existence of motives, however reasonable those motives may appear, is no proof of the sanity of the accused, since they may have as their origin data which, however apparently reasonable, are still the offspring of a perverted intelligence. In the case of Feldtmann, the homicidal act proceeded from an inability to gratify a criminal passion, which passion, it was evident, was the result of disease. Again, how many motives, according to the evil dictates of our nature, such as jealousy, hatred, or revenge, known to be cherished against a certain individual, may, in the event of his death, be adduced in proof of prearrangement as well as of premeditation, and those feelings have their origin in true data operating on a monomaniacal mind, as we had illustrated in the case of Ovenston. They, then, who would affirm that an individual is responsible for his acts, unless they have been the result of "motiveless impulse," must confine the number of insane within a very narrow limit, and ignore the truths of those verdicts which in many of the most important cases have been recorded.

It follows from these considerations that, though the apparently wanton atrocity of an act cannot be rejected in our estimate of its source, yet it is in itself no proof that its perpetrator was insane. The suddenness of an act is no argument against its matured premeditation. The presence or absence of motives cannot be regarded as of other value than such as they derive from their association with the mind of the accused, rather than the circumstances under which the criminal act was accomplished.

We believe that there are conditions of the system in which morbid impulses exist, inexplicable by any of the ordinarily recognized psycho-physical conditions. How many individuals to all appearances enjoying physical and mental health, of whose many amiable and excellent qualities no doubt could be entertained, have, notwithstanding their apparently healthy state, acted in such a manner as not only outraged those laws necessary for the welfare and preservation of society, but also with the full consciousness of the impropriety of their conduct, committed some act so diametrically opposed to the previous current of their lives, so perfectly at variance with every probable motive or conceivable advantage, so trivial in its

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inducements, and yet so lamentable in its results, that common sense rejects the idea of rationality in its consummation. That under such circumstances criminal acts are perpetrated, when the free agency of the individual is for the purpose of their commission suspended, is undoubtedly true. We admit the accused, as far as the possession of intellectual powers go, to evidence the ordinary exercises of a cultivated mind, and, as far as the moral faculties are concerned, to be perfectly alive to the best and tenderest duties which strengthen the ties of social life; and yet, occasion offering, a sudden yielding of the justly-balanced mind occurs, whereby the object of our sympathies becomes placed in a position strangely analogous to, yet widely—very widely—differing from the operations of vice. The solution of this psychical problem may be presumed to rest in an investigation of the laws of psycho-physical sympathy: more particularly as the examples illustrative of the phenomena to which we refer are to be met with more frequently in females, usually of susceptible nervous systems and sensitively-constituted minds. That there are times in which the female sympathies are keenly alive to external impressions and the mind in a condition of morbid receptivity, those intimate with feminine diseases must be fully conscious of—a condition presenting a strange compound of physical and mental hysteria, this condition chiefly manifesting itself at that period of life when nature, undetermined respecting the perfection of her processes, disarranges the harmony essential for self-control, without at the same time manifesting any special indication referable in a sufficiently marked manner to either the physical or mental constitution. At such periods, strange physical sensations are experienced, and morbid desires flit across the mind without sensibly interfering with its just and proper exercises. Pending this recurrent psychopathical condition, the psychical and physical sympathies become so completely interwoven that they immediately respond to the suggestions one from the other, when, unless restrained by a principle of action capable of resisting their reciprocal and combined influence, the individual becomes committed to some act of egregious folly, it may be, bearing all the similitude of crime. In the individual enjoying perfect health there are instances in which analogous feelings are experienced, when circumstances engender the predisposition,

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and a proximate cause for its development almost coincidently occurs. How many have from being placed in an elevated and unguarded position, when the physical influence of the atmosphere and the psychical influence of the ideas react on each other, experienced such a revulsion of the feeling of self-preservation as urged them to commit a suicidal act, to which their unclouded consciousness, morale, and natural inclinations were opposed! We believe that in the condition of the female system alluded to, acts are perpetrated as little according to the healthy, free, and deliberate exercises of the individual, and for which they should be considered as equally irresponsible; in which previous to their commission, to all appearance, perfect physical and mental health existed; and subsequent to which a full consciousness and all the bitterness appertaining to the commission of the act are experienced. Yet in cases of this nature, at such a moment, the individual was, for the time, altogether irresponsible; being irresistibly urged to the commission of the act to which the mind was morbidly attracted, and for which the motor powers simultaneously yielded. The case of Charles Mathews in a measure illustrates this phenomenon, as witnessed in the male, while in the female many of those otherwise inexplicable examples of so-called crime which occur in the persons of honest, unexceptionable characters are to be similarly classed.

A form of disease already considered, kleptomania, however connected with physical indisposition, may be first evidenced by derangement of the moral faculty, rendering it subservient to morbid impulse, the integrity of the moral principle seeming to be intact, except as far as may be inferred from the impulsive act. It is also to be distinguished from monomania, inasmuch as the intelligence, when aroused to its consideration, comprehends the full and true relation its commission involves. We are led to form this opinion chiefly from the known character of many who have, from such impulse, been committed to apparently criminal acts. While recognizing the principle which should guide the diagnosis of such cases, we are, at the same time, fully conscious of the almost interminable difficulties besieging its application. We believe, however, that as the reciprocal sympathies of mind and body are more closely studied, a clearer conception of this condition will be established, and phenomena but imperfectly understood be more fully appreciated.

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We have mentioned the necessity of a principle of action as necessary for self-restraint. From this two questions arise:

1st. To what is this principle of action to be referred?

2d. What are the conditions essential for its operation?

The answer to the first inquiry happily rests with every individual. The well-regulated mind may be said, in the ordinary affairs of life, to act aright instinctively, not from any premeditation that a particular line of conduct is right, but because any other line of conduct would at once become the occasion of mental pain. Self-examination assuring us that this principle of action is fixed in the consciousness of each, we are led to the conclusion that it cannot depend on the mere suggestions of the intelligence, nor yet result from the abstract operation of the emotive faculty, for the harmonious coadaptation of each of these is essential for its due exercise. This principle of action is a pervading power which rests in and yet is not of the mind. Education and religion can but develop and direct; they cannot create it: its existence being neither dependent on the operations of the one nor capable of being replaced by the offices of the other, since without it the mind would be but an instrument for superior animal pleasure, and religion a motiveless exercise of what should therefore be regarded as senseless observances. Its light may be obscured; it cannot be quenched. Its course may be perverted; it cannot be stayed so long as intellectuality appertains to man. Piety, truth, love, and justice are its growth; rational self-love being as nothing in its estimate, individual enjoyment but the least of its results. It is in truth that *divinæ particula auræ* which, reflecting on the creature brightness from another sphere, raises him above the conflicting interests, miserable jealousies, and many petty inducements to crime, besetting on all sides his journey through a changeable community and a changing world.

The condition essential for the operation of this principle is psychopathic freedom of mind. We use the term psychopathic as contradistinguished from metaphysical freedom on the one hand, or that condition in which vice, with the skilful sophistry of guilt, exercises its pernicious influence on the other. In the character of cases to which we have so imperfectly alluded, this psychopathic freedom is for the time suspended; the regulating principle being placed in abeyance;

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the act denoting but the mechanical expression of a passing morbid condition.

It may be urged that the object of the law is to so correct the mind of the offender by punishment, and to so confirm the principles of the community by example, that while the depraved may be reformed the weak may be strengthened, and thereby this principle of action be maintained in its fullest integrity. Admit all this. Even allow that the recognition of an irresistible impulse, previous and subsequent to which full rationality is affirmed to exist, offers an easy explanation for any crime, and yet one cannot deny that cases of this nature have occurred and may occur again. Law in their adjudication when disease is established becomes divested of its severity; since justice restrains its exercise to their preservation from injuring the community, and to the personal safety of the individual, in whom such a manifestation must be regarded as being at least indicative of a psycho-physical condition requiring anxious and close attention.

The question of punishment is merged in that of volition and health. If disease, as contradistinguished from vice, be present; if insanity, the result of abnormal psycho-physical action, as distinguished from that unsoundness of mind and depravity of morals which are characteristic of the operation of sin and crime, be allowed to exist, we confess our inability to propound any rules by which the creature could be thus constituted the avenger of his Creator; or, allowing the doctrine involved in such a practice to be correct, we know not any means that should determine with certainty the extent of such morbid operations, and thereby assign a limit to our endless conjectures. Sooner, to use the words of Ideler, "could we see upon the disturbed waters the clear image of what surrounds us, more easily calculate the status of every wave, than find in the ebb and flow of such thoughts the mirror of our relation to nature or the law of our changing emotions."

The close association which seems to exist between suicidal and homicidal mania has attracted the attention of most writers, who attribute them both to a morbid perversion of the natural instincts; the same causes which originate one being adequate to the production of the other. The Monument in London, the Place Vendôme in Paris, have furnished many

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examples in proof of this assertion. Though the act of self-destruction be opposed to the first principles of our nature, yet we incline to the opinion that in every instance the commission of suicide cannot be regarded as a proof of insanity; since it may but argue the acme, or last desperate effort of vice in one who, knowing that the just rewards of his evil deeds await him, in recklessness of his life, by a final resolve attempts to anticipate the operation of the law. Such an act we do not believe is a whit more indicative of insanity than that dogged indifference to final judgment and public execration witnessed in the conduct of many of the worst criminals, whose last ambition seems to be that their equally reckless companions among the motley crowd may witness their "dying game." We cannot, therefore, in all cases, infer the animus which led to the homicide, from the mere fact of the subsequent suicidal attempt, be it successful or otherwise.

The diagnosis of this particular operation of disease, in its simple and uncomplicated form, rests chiefly on negative rather than positive grounds; and may be derived from events preceding, pending, or subsequent to the commission of the deed. In contrasting homicide the result of disease with homicide the result of vice—though they may have many features in common; though the nature of the acts be identical, and the means adopted for their perpetration the same—we still have abundant proof to satisfy us that—

> "Murder, though it hath no tongue,
> Will speak with most miraculous organ;"

since each day declares that the mysterious working of Providence guides the retributive justice of man and enables him, by a chain of circumstances, to arrive at truth; though craft, and subtilty, and the deep resolves of human intelligence have been strained to the uttermost for its concealment.

Following in the steps of other writers, we may thus particularize some of the principal differences between the criminal and insane impulse:

a. The criminal premeditates his plan, and, of necessity, selects his victim. The impulse has no premeditation, and has not, of necessity, a selection.

b. The criminal act is the consummation of previous criminal desire. The impulsive inclination either originates with the act or is unassociated with the object of it.

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c. The criminal act is generally complicated. The simple impulsive movement never is so.

d. The criminal conceals the deed he purposes to commit, and after its perpetration endeavors to escape its consequences. The impulsive action is acknowledged and deplored; while, subsequent to its commission, its detection is not avoided.

e. The criminal, if he has not accomplices, has at least vicious associates and explicable motives. The impulsively deranged never has accomplices, is without rational motives, and may, in his social relations, be unexceptionable.

f. The criminal usually selects victims against whom hostile feelings exist. The impulsive acts without discrimination, and not infrequently violates all natural affections.

g. The criminal carries his evil practices no further than the gratification of his evil passions in the commission of the act may demand. The accomplishment of the impulsive act by no means removes the impulse or satisfies the morbid propensity.

In our considerations respecting the varied forms which monomania may assume, as also in our analysis of unsoundness of mind, chiefly evidenced through derangement of the moral faculties, we have perceived that the supervention of a homicidal impulse may, in many cases, constitute but the climax of pre-existing symptoms. The most we can, therefore, attempt is to state what those general rules are which may guide us in our opinions, and enable us to recognize the various forms in which impulsive insanity is known to occur—when, by the careful and minute investigations of all pre-existing, coincident, and subsequent facts, we may at least find the nearest approximation to truth.

We venture on the following conclusions as being of importance for such an end:

I. Impulsive insanity exists as a special form of disease in its manifestations uncomplicated by other phenomena.

II. The patient may be fully cognizant of the civil and ethical relations of the particular act from the perpetration of which he is unable to desist.

III. In one class of cases the impulse may be successfully controlled, and a considerable period intervene between the origin of the impulse and the commission of the offence.

IV. In a second class of cases the commission of the offence is coincident with the origin of the impulse.

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V. In both these cases the previous history may fail to account for the morbid phenomena.

VI. The diagnosis of this affection may be stated to rest in the positive nature of the crime and the negative character of the symptoms.

VII. Though pathology fails to establish fixed psychopathic relations for this form of mental unsoundness, yet the existence of every lesion of the nervous structure becomes an important element in diagnosis.

VIII. Observation affirms that psychical sympathy, or imitative propensity, is one of the most frequent of its exciting causes.

IX. Where the predisposition has been established, the immediate or proximate cause of its development may rest in any object capable of exciting undue emotions, more especially if such excitement accords to the predisposition.

X. This predisposition may exist without manifesting such signs as would lead to its detection, previous to the commission of the homicidal act.

XI. The proximate cause of the homicidal impulse has, of necessity, no further relation to the homicidal act.

XII. When the homicidal impulse arises, pending other forms of mental disease, its existence is to be regarded as a symptom of such disease, and to be explained accordingly.

XIII. That under such circumstances the special characteristics of this homicidal impulsive affection are lost in those which appertain to that form of insanity with which it may be conjoined.

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CHAPTER V.

We have endeavored to show the nature of many difficulties investing the questions under our consideration, and for the appreciation of mental diseases have impressed the necessity of closely scrutinizing, through a careful system of analysis, the psychical and physical relations. It does not, however, follow, because experience has declared this to be the best, if not the only reliable plan by which to arrive at truth, that it will, therefore, always prove adequate for guidance to such an attainment, since cases not infrequently occur so strangely anomalous in their character that medical men of great experience differ widely in their opinions respecting them. Shallow reasoners have thence presumed to argue the incapacity of psychopathic science rather than to acknowledge its difficulty or obscurity. We are free to allow the latter, and, in consequence, to admit the necessity for the recognition of certain principles which may confine, as far as possible, the solution of scientific problems within the range of scientific certainty, and so, in a measure, render them independent of individual opinion, the value of which is proportionate to the capability and opportunity for its formation.

Observations in the abstract sciences lead us to refer corresponding results to identical causes; experimental philosophy enabling the analyst to so arrange the elements under consideration that their properties and relations may be rendered matters of demonstration. Every established fact is thereby constituted an available and known power, which inductive reasoning may, with confidence, employ in the solution of future phenomena. It is different when we come to apply the same principle for the establishment or appreciation of phenomena whose source is beyond our reach; for being unable to control or define the order and succession of their arrangements or combinations, we are soon convinced that each new appearance must be regarded as but a result of a varia-

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ble power, from which, however justly we might otherwise reason, we should, consequent on the absence of positive data, be unable to predicate a necessarily accurate conclusion. In the prognosis of disease this is especially verified, the nearest approximation to truth in our opinion being, not that which is easily explicable by theory, but which is most in accordance with experience. This possible uncertainty in the prognosis of disease must be distinguished from an incapacity for the due appreciation of its nature. The former involves a question of experience in the progress of vital actions; the latter, the capability of appreciating physical media for the exposition of these actions. The one anticipates the future—what may be: the other refers to the past—what has been or is. The difficulty of the former rests, not so much in determining what are the constant, but in calculating what may be the accidental, concomitants of any particular phenomena: the obscurity of the latter seems to be dependent, not on the estimate of material changes, but their pervading immaterial agency beyond our reach. Notwithstanding such obscurity, there can be no greater error than the supposition that because the study of medicine involves the estimate of inaccessible momenta from their accessible results, its practice should be regarded as speculative, or other than an inductive science; since the close observation and careful appreciation of those laws by which physical actions and psycho-physical relations appear to be governed have so supplied the process of experiment that, though vital agencies are intangible, we are enabled to estimate with an approximate, if not a mechanical certainty, for all practical purposes sufficient, the value of their manifestations; while, in our appreciation of cases for which no analogy exists, we must bear in mind that while experiment deals with matter, observation is the analytical agent by which the form and quality of mental disease is estimated.

That we may not involve familiar truths in any unnecessary intricacy of argument, we shall regard certain facts as self-evident propositions, and allow the psychical and physical constitution to vary in each individual. As our knowledge of mind and matter is merely relative, it becomes essential that, for the appreciation of undetermined phenomena, we recognize a standard for comparison which, notwithstanding

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the endless diversity of their several relations, may be equally available for all and appreciable in each. This standard we possess in that condition known as health, which physically implies the normal exercise of the several organs in their mutual relations for the maintenance of the body; and psychically, premises a capability of these organs perfecting such functions as are involved in the expression of the mind. We know not wherein the principle of vitality, as manifest through the physical structures, rests: we perceive the integral constitution and relation of the several elements of these structures to be transmuted and impaired in every conceivable manner, and yet life, though pursuing an erratic course, to still pervade and influence the whole. The constitution becomes, as it were, "broken up," indefinable disease being present. For the diagnosis of such conditions, physical changes may prove inadequate, as being not infrequently latent. We infer, however, that they are invariably present, because we do not believe that such a phenomenon as a purely functional disease exists; its assumption would open the path to endless absurdities in medicine, as leading to the recognition of immaterialism on the one hand, or inutility of organism on the other: both of which propositions are opposed to observation and at variance with admitted experience. It is right, therefore, we be satisfied that the true medical interpretation of the term "functional disorder" is disease whose physical manifestations are masked, but whose operations are evidenced. Allowing morbid changes of such a nature to be present, we ask—Are we enabled to speak with confidence respecting their limit, or to define how far they render an organism dependent on the adjuvant powers of other viscera? Though observation and experience lead to the inference that life may not be materially shortened through the presence of certain visceral irregularities, what physician would therefore regard them as of little consequence—mere matters of inconvenience? It is too frequently witnessed that which has been termed "functional disease" is only the appreciable manifestation of some destructive process, whose presence is thereby proclaimed. The records of the pathological societies leave no doubt on this point. While admitting such, we are glad, for the honor of medicine, to declare its rarity. Bearing these facts in recollection, how far are they applicable to the diagnosis of dis-

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ease which can only be appreciated through its psychical operations?

The foundation of just psychology rests on the admission that without freedom of mind there can be no freedom of conduct. Mental freedom, as psychically interpreted, implies a normal condition of that organism through which mental influences are expressed. Were we to admit the possibility of the mind, as an independent essence, being diseased, folly, sickness, and sin should be identified: happily for ourselves, observation, reason, and revelation reject such a supposition. Were we to regard the mind as but the aggregation of functions, each possessing an independent existence, and disregarding the dictum of Lord Brougham, thereby admit, in the abstract, the possibility of a partial disease; before we could, in practice, estimate the extent of its influence, it would be necessary to determine the mutual reactions which the several functions are adequate to exercise, and define the degree in which the integrity of one power was capable of supplying or counteracting the influence of another; as also the relation any special deficiency bore to the whole. We possess no means of doing so except through the study of the individual character whose sanity may be under consideration. The problem is one which in recent decisions has found a satisfactory judicial solution. Viewing the cerebral structure simply as the organ for mental expression, we reason from effects to causes, and infer the imperfection of the instrument, from its defective operations; again, arguing from causes to effects, we declare the mind to be unsound because of the material incapacity for the healthy expression of those several elements, functional or otherwise, whose perfection is essential for its normal action. This may appear to be affirmation without proof, an argument in a circle, as inferring that because a man is deranged, his nervous apparatus is diseased; or because his nervous apparatus is diseased, a man is deranged. We are met with the fact that cases are on record apparently subversive of both propositions. Physicians, however, do not contend for their capability of solving every mystery in disease, but they are confident that their knowledge and experience render them the most competent for such a purpose. If then physicians regard insanity as the expression of morbid changes, can they define its extent, fix the range of its influ-

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ence, or with certainty affirm the ratio which those mental agencies they admit to be at fault bear to the general expression of the whole? especially keeping in mind that though an error in the diagnosis of physical derangements can, through many agencies, be rectified, an error in this particular instance may blight fortune, ruin character, or consign to death.

Taking a different view, and allowing an independent, indivisible existence and action of mind, we are brought to investigate the extent of mental unsoundness which may in any case be present: What criteria for judgment do we possess? The definite expression of the indefinite power proves nothing of the mental condition beyond its particular manifestation, while it is the value of that manifestation we are required to determine from its relation to the unknown power. Whichever view we adopt, the admission of unsoundness of mind, as distinguished from natural incapacity, or ignorant incompetency, that is insanity in its full signification, must, in its individual relation to law for the purposes of justice, be regarded as entailing, *ex necessitate rei*, irresponsibility, while in its relation to the community, for the maintenance of the public safety, it becomes requisite that society be protected from the danger which might result, were those so affected permitted to continue unrestrained. The spirit of natural equity and every logical argument are opposed to any other principle whose adoption has already been urged by the ablest pens. We cannot, in addition to what we have stated, refrain from expressing our belief that more danger has resulted to mankind from the recognition of the doctrine of partial insanity and partial responsibility, leading to the confounding of wickedness and crime with disease, than those who propound such doctrines would be disposed to admit. Thence have arisen so many ridiculous and untenable opinions, unsound and illogical propositions, unsafe and dangerous precedents. A regards motive as sufficient test; B requires knowledge of morality or immorality of act; C demands a comprehension of its relations to the law; D argues from the presence or absence of self-restraint; E considers the existence of delusion essential; F associates delusion with act; G rejects the mental unless corroborated by the physical condition; H commingles insanity with crime; and all contribute somewhat to involve the question in almost inextricable perplexity. We might extend this

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list: to do so would be merely to repeat what we have already propounded.

There is one doctrine we have reserved for special comment —that which would regard a culprit's accountability as "a perfectly distinct subject of inquiry from his mental condition;" [58] thereby rejecting the only elements for the formation of an opinion, since the accountability must rest in the mental condition. The author of this proposition thus writes: "But here comes the practical difficulty in the way of the settlement of this question. If we admit that lunatics, affected with partial insanity, may be, under certain circumstances, responsible for their actions, and under certain other circumstances not responsible, how are we to decide when they are to be exempted from punishment and when not? And further, supposing that they are, under any circumstances, fit objects of punishment: how is that punishment to be regulated to their offence, and when is it to be administered?" [59] The answer to the first of these questions is propounded in the proposition laid down by Lord Erskine in his defence of Hadfield—the relation of delusion and crime. This, however, often replaces one difficulty by another of equal, if not greater, magnitude. We speak of obscure cases. We further read: "As to the second question, namely, the propriety of making lunatics, under any circumstances (even when proved to be sufficiently rational to be capable of self-restraint), amenable to punishment, I think that every one will agree with me in concluding that so long as such a malady as this exists, no individual ought to be regarded as a fit subject for punishment, and, least of all, ought he to be sent to an ordinary prison to undergo the penalty of his misdeeds. The plain and obvious duty in all such cases is to forward him to a proper asylum, to have his malady skilfully treated; and, until this is done, nothing else ought to be thought of. But if, owing to the use of measures proper for his recovery, he is, after a time, restored to health, it may then be a question whether he is not properly punishable for crimes wantonly committed in his insane condition, though unconnected with it. In no other way, I conceive, can punishment be brought to bear on the insane." [60] This startling proposition is referred to that tribunal which "has been in use in these countries from time immemorial, and which has justly been regarded as the great bulwark of our lives and

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liberties." We read: "The two questions they—the jury—would have to decide in every trial of this nature would be, first, is the individual really insane, and if so, what is the nature and extent of that insanity? and, secondly, had that insanity any direct influence in leading him to the perpetration of the crime with which he is charged?" In other words, the complete problem remains to be solved. We have expressed ourselves so fully on this point that we shall rest satisfied with inquiring, May not self-restraint be the strongest argument in favor of irrationality, as showing the predominance of some fixed, insane, latent purpose, which places all other feelings in a state of subserviency? While the malady exists and the patient is regarded as being inadequate to appreciate the corrective effects of punishment, why should he, when his reason is restored, be held accountable for those acts which its perversion resulted in, and from which he was at the time, in virtue of such a perversion, absolved? Is he not thus declared to be responsible as regards the effects, while he is considered irresponsible as regards the causes? It is true that justice is not to overtake him "until after a time" to be spent in "skilful treatment." To what length may this time extend? whether for a day, a week, a month, or year? Truly, when reading such propositions, we may well exclaim with the venerable Vogel that "great powers of reason are requisite to understand men destitute of reason."

"The execution of an offender," writes Sir Edward Coke, "is for example; the execution of a madman would be a miserable spectacle, and one of extreme inhumanity and cruelty." This most learned judge proceeds to state "a man *non compos*, as to his life the law of England is that he shall not lose his life for felony or murder, because the punishment of a felon is so grievous. To lose his life in such odious manner for he shall be hanged between heaven and earth as unworthy of both, and other penalties '*ut pena ad paucos; metus ad omnes*,' but the punishment of a man who is deprived of reason and understanding cannot be an example to others." There are, notwithstanding this and similar declarations on the part of others equally eminent, many who contend that the most effectual prohibition of crime rests in the public punishment of all offenders; affirming as their reason that the mind adequate to perfect the commission of any vicious act

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should be held responsible for its consequences. They who argue in such a manner respecting those within the dictum of Sir Edward Coke, have but a limited conception of the operation of the disease, and take a narrow and one-sided view of the questions of public safety, as well as of criminal reform; while as regards the commission of the act, they confound the persistency of madness with the consistency of sense, and shut their eyes to the fact that it is not the mere act, but its psychical association, which constitutes the crime. The object of punishment according to Sir Edward Coke being twofold—reform and example—punishment inflicted on an individual for acts accomplished during his insanity must be wanting in its chief design—the reformation of that mental condition from which such act had resulted: inasmuch as reformation implies a full recognition of the varied relations of the act, which recognition, the presence of the insanity inducing to its commission is altogether opposed to. Considered in its relation to the law, for the purposes of example, in the execution of the insane, we, at best, but vindicate a civil enactment, directly opposed to those natural instincts which constitute for each one a code of innate jurisprudence of which our sympathies are the best conservators: and in doing so, disregard principles, the chief support of those laws whose vindication is sought in their violation. It is true that some crimes are so heinous in their nature, and so serious in their results, that the means best calculated to prevent their repetition become questions of the first national importance. The execution of the insane offender is urged, as a matter of public utility, by many who contend that for the regulation of society utility alone should be the criterion of right and wrong, and ought, therefore, to be the object of the legislature. This is an argument as false in its principle as it is dangerous in its application. The moment general utility trenches on individual justice, public safety becomes thereby impaired, and the way opened to endless encroachments; since what, under such circumstances, is the general welfare but the aggregate representative of personal interests? We contend, on the principles of truth and equity, not through feelings of pity or fear, that he who raises his voice to-day and demands that the insane offender be sacrificed to popular clamor—we will not insult common sense by calling it justice—to-morrow may himself be stricken, and re-

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quired to expiate, not his crime, but his sickness, at that shrine his erroneous philanthropy has labored to erect. Let medical men rather devote their energies to the study of insanity as a disease, contradistinguishing it from that unsound or deficient mental regulation which vice engenders and evil passions direct; let them regard disease as a matter for cure, crime as an object for correction, and we are satisfied that there will be far less of that vagueness which baffles justice by misleading juries, and humiliates medical science in reducing it to a study of probabilities, without a rule to guide or a boundary to limit.

It is true that with insanity the worst criminal disposition may be conjoined; that "intriguing, unruly, vicious madmen" are to be met with, who, reasoning within their insanity, knowing that they are accounted insane, presume on their immunity from punishment, and, therefore, freely pursue their wicked propensities. A criminal disposition appears to be associated with, rather than to result from, a particular mental condition. In the question of their restraint is involved that of their correction, which should be regarded as implying the recognition of their amenability to treatment, rather than their responsibility for conduct, and is, perhaps, one of the strongest arguments which—whether justly or unjustly it is not our present object to discuss—has been advanced for the establishment of special institutions, to which the insane with such exaggerated criminal dispositions might be committed. Dr. Bucknill, in a work replete with practical suggestions,[61] has well distinguished "those who have become insane from the long indulgence of criminal propensities, from those who have become criminal for want of timely protection during their insanity; those in whom some degree of imbecility render a vicious character still more intractable, from those who have done wrong conscientiously believing it to be right; those accused of some slight offence for which they have never been tried, from those convicted of heinous offences, and after conviction becoming insane." A close analysis of the several degrees in which insanity and crime are related, as well as of the association observable between vice and disease, are adduced by Dr. Bucknill as arguments for a separate asylum for "lunatics of criminal dispositions," or the establishment of "a place of treatment distinct from the asylum and the prison,

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and partaking of the characteristics of both; with more variety, leniency, and indulgence than are to be found in the latter; with a stricter discipline and a compulsory industry unsuited to the former." The basis of such an institution would be the recognition of insanity rather than crime, as distinguished from ordinary prisons in which crime rather than insanity is to be treated. This amenability, which has reference to insanity, is essentially different from that responsibility which applies to the sound in mind. In the one we recognize disease, and its accidental or incidental accompaniment, requiring painful and severe remedies, whose object is the correction of certain influences, through the application of means which experience proves are adequate to such an end—their use to cease when the design for which they had been instituted is accomplished. In the other, we punish the deliberate indulgence in crime with such pains and penalties as society may deem commensurate for the purposes of example as well as reform. The one is a matter of psychopathic treatment—the other a question of judicial and legislative policy. The one should never pass the bounds of daily observation and curative reasoning—the other may at once fulfil the requirements of society by the forfeiture of liberty, the continuance and perpetuation of physical correction, or, it may be, the deprivation of life.

The practical recognition of this principle opens a wide field for inquiry, wherein the questions of restraint on the one hand and correction on the other are brought into association. Its application can only have reference to the treatment of those who have been admitted into institutions as being insane rather than criminal, since it is the estimation of the individual's conduct in reference to his insanity, not in reference to the law, which should guide the employment of any means determined on. The inquiry thus merges into one of restraint and discipline, in a possible but rare case; for where sense of responsibility sufficient to appreciate the moral influence of correction is present, it is but reasonable to believe that such a condition of mind argues a capability for self-regulation, demanding that the prerogative of constitutional justice should be exercised for the benefit of the community and the diminution of crime; in other words, that law should prevail; while where the sense of moral obligation and capability for

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intellectual guidance are so equally impaired that the employment of such means should prove merely productive of mental or physical suffering, it would be cruel and unjust to hold disease as criminal. Rewards and indulgences are known to exercise the most beneficial influences on the guidance of the insane mind; there are, so far, grounds for the inference that prohibitions and restrictions would prove equally beneficial in the reformation of their vicious dispositions, for there is no greater error than the supposition that the insane are insensible to those agencies which in the ordinary affairs of life influence the conduct of men. It is far from our wish to constitute the physician the judge, but we have no doubt that in the criminal jurisdiction of the country many important changes will yet be perfected which the psychical estimate of crime, in its intellectual and moral relations, shall dictate. Even now the good work is in progress. The object of our prisons being as much for reform as reproof, they have, in a great measure, ceased to be so many centres where, under the old system, the young found encouragement in evil for their future career, and the aged were strengthened in their crime. In the medical direction of those compound cases it becomes evident that "it is a point of great difficulty, in fact almost an impossibility, to detect the line of demarcation between responsibility and irresponsibility, or where one commences or the other terminates."[62] We cannot, therefore, do more than, while admitting the principles which should guide, acknowledge the obscurity enveloping their individual application, and as far as is possible forbear from confounding disease with crime, or shielding iniquity from those obligations which the general interests of the community demand should be maintained inviolate.

In regarding insanity as a disease demonstrative of an abnormal condition of the cerebral structure for psychical action, we are led to institute a further analogy between its manifestations and those which indicate other lesions of the nervous system. We know that a special peculiarity of such affections is their subserviency to the laws of periodicity. The two common affections of epilepsy and hysteria may be quoted as illustrative of the latent persistency and accumulative tendency, as well as profound obscurity, by which neurotic diseases are characterized. It is a matter of experience that

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among individuals in whom the predisposition for those diseases has been established, causes which, under ordinary circumstances, would avail nothing, prove adequate to arouse the predisposition, and are capable of developing that morbid impetus resting beneath the surface of what, to common observation, would appear to be ordinary physical health. Examination of a patient between the periods of attack may afford little evidence of the mischief at work: a cause capable of acting on the predisposition occurs, the impetus is aroused, and the acme of the disease results; a period of repose follows, in which it would be folly to presume, because no active operations were manifest, that their source was not the less truly present. Curative measures may triumph over such conditions, and health follow on the exertions of the physician. The progress of analogous diseases, manifest through mental affections, is even more subtle. Insanity becomes developed, its symptoms subside, apparent rationality is present; a recurrence of the disturbance follows, again to be succeeded by a calm; curative measures accomplish their end, and the calm becomes perpetuated. A question thence arises—Are physicians, pending the abeyance of morbid manifestations, warranted in affirming the presence of disease? To this must, in many cases, be afforded a positive reply, since this very abeyance may be the chief characteristic of the disease whose presence is inferred. How, then, in the absence of unusual manifestations, are there grounds for such an inference? The response is—From the previous history of a particular case, and knowledge of the peculiar characteristics of the affection under consideration, and a contrast of the periods of physical and psychical repose. May not the exercises appertaining to either sphere be so far accomplished that, for the ordinary purposes of life, they prove sufficient? Pending this seemingly healthy state, some cause apparently trivial, or, it may be, considerable, occurs; a convulsion is unexpectedly produced, or a paroxysm of insanity follows. In both cases the predisposition requires but a slight occasion for its development, and in both cases, had the immediate exciting cause been prevented, the same semblance of health might have been maintained. This practical fact must ever be remembered, as showing the great difficulty enveloping the estimate of many cases in which, where insanity had been known to exist, but where its evi-

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dences have subsided, acts of a criminal nature ensue. It is true that in many instances the mental disturbance is of such a decidedly recurrent character that those glimpses of reason which intervene between each paroxysm are justly regarded as but so many calms, whose occurrence is an occasion for thankfulness, even though their duration be matters of uncertainty. That during such intervals, acts, in every way indicative of perfect sanity, are accomplished, is not denied, wills executed in such intervals being held valid. It is contended, however, that we are not invariably at liberty, under circumstances of this nature, to infer that the mind is really sound because it is seemingly so; or to, in all cases, hold the individual responsible for actions of a criminal nature committed in such intervals, since the act to be considered may, in itself, be the developing of the latent morbid condition. It is this latter fact that must guide us in our estimation of such cases, while for their more particular appreciation, those general principles we have already discussed come into operation. We transcribe the observations of Dr. Combe on this point, as expressive of the condition of individuals who, having recovered from an attack of insanity, are again brought under examination: "However calm and rational the patient may appear to be during the lucid intervals, as they are called, and while enjoying the quietude of domestic society or the limited range of a well-regulated asylum, it must not be supposed that he is in as perfect possession of his senses as if he had never been ill. In ordinary circumstances and under ordinary excitement his perceptions may be accurate and his judgment perfectly sound, but a degree of irritability of brain remains behind which renders him unable to withstand any unusual emotion, any sudden provocation, or any unexpected and pressing emergency. Were this not the case, it is manifest that he would not be more liable to a fresh paroxysm than if he had never been attacked. And the opposite is notoriously the fact, for relapses are always to be dreaded, not only after a lucid interval, but even after perfect recovery. And it is but just, as well as proper, to keep this in mind, as it has too often happened that the lunatic has been visited with the heaviest responsibility for acts committed during such intervals, which, previous to the first attack of the disease, he would have shrunk from with horror."[68] Lord Brougham's views respect-

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ing partial insanity are important, as showing how closely the reasoning of the philosopher corresponds to the experience of the physician, even though exceptions arise.

To those familiar with unsoundness of mind it is a matter of experience that by far the most dangerous class to be treated are patients who show the least evidence of their condition. Many recorded instances might be adduced where the most fearful crimes have resulted from very trifling causes, those causes being of a nature appreciable by the sane mind, and explicable by the ordinary occurrences of life. It is an error to suppose that rational motives acting on a disordered mind will not present equally lamentable results as the most extravagant suppositions. It matters not to the insane whether the motives be real or imaginary; they in their operations become transmuted, ordinary motives acquiring extraordinary significance. "It is, therefore, the relation of motives to the mental conditions at the period of the perpetration of the act, rather than the accordance of these motives of the character of the act," that should guide opinion. Were proofs required, we might quote many sad examples of suicidal and homicidal intent, accomplished during periods when the seeming quietude of the sufferer led to the relaxation of the close scrutiny previously preserved. The nature of such cases is so patent that the proposition of irresponsibility will be acceded to, and in individuals so afflicted the operations of disease cannot fail to be duly appreciated.

It here becomes a matter for consideration—How is society to be protected from the ill consequences of individuals so affected being at large? Such an inquiry, though full of interest, it would be foreign from our purpose to enter on. It seems, however, next to an impossibility that, in many cases, previous to the active development of their disease, any decisive measures could be adopted, since each separate case becomes a proposition in which the liberty of the subject, the unity of justice, and the well-being of the community are equally involved.

Passing from the consideration of mental conditions, which may be regarded as but so many lucid intervals, we are led to the estimate of cases in which, where insanity has been present, what may be looked upon as a permanent convalescence ensues, pending the continuance of which crime is

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perpetrated. A question arises respecting the offender's accountability. We will presume it is established, from sufficient proof, that what is believed to be a complete recovery has taken place. The mere fact of insanity having existed, though being of itself a strong argument in favor of the accused, cannot be regarded as *per se* exculpating general vicious practices; at the same time, when the nature of insanity as indicative of disease is duly estimated, its tendency to relapse during convalescence and to recur when cured borne in mind, it will be acknowledged that in the estimate of criminal acts on the part of those who have been so afflicted, many important points for consideration arise. It is known that where a disease of a recurrent character has once been established, but a slight occasion proves adequate for its subsequent development; causes which to the ordinary constitution are innoxious, finding a morbid receptivity existing, acquire therein undue power, and eventuate in an unhealthy and exaggerated manner. The individual who has been insane must, therefore, in any unusual act, be always the object of suspicion. In many instances there is nothing to distinguish their mental state from that of ordinary persons, and in no way can the character of the act be associated with the nature of the previously existing disease. An inquiry arises respecting the relation of such acts to the mental condition of the accused, and of the accountability of the accused to the law. In the estimate of cases of this nature it must be borne in mind that there is no necessary connection between insanity and crime; that as regards the individual, crime and insanity can coexist; that as regards the law, an insane may be a criminal act; but, strictly speaking, there is no such occurrence as an insane criminal act. The insane act is not criminal, but a special manifestation of an existing disease, which circumstances direct into a particular channel. If we believe that no disease is present we divest the act of this important signification, and, reducing it to an ordinary fact, seek to inquire if, in a mind which may be presumed as being constitutionally weakened, the same capability of resisting inducement to crime exists. Experience affords a negative reply. It is not denied that by individuals who have recovered from attacks of insanity criminal acts entailing deep responsibility may be perpetrated; at the same time, it is a matter requiring but little argument that crime,

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which at all times indicates deficient or defective mental regulation and excessive influence of evil passions, finds a diminished capability for resistance and a greater facility for adoption in the minds of men who have suffered from mental disease. The ordinary laws of our country, in their practical operation, recognize different degrees of culpability in reference to the same offence. We have, so far, a practical acknowledgment of a modified exercise of judicial authority which, in all instances where insanity has been known to have been once present, should be extended, and at least tend to the prohibition of capital punishment in such instances. This, with rare exceptions, appears to be the principle of judicial action.

In many cases, though reason is restored, the disposition seems to have undergone a complete change, which leads to the belief that the morbid action is rather kept in abeyance than wholly removed. When some unusual act occurs, conduct which had previously been regarded as of but trifling significance becomes invested with special interest. Many are ready to prove that grounds existed for inferring a return of disease, against whose results no precautions had been taken. Esquirol bears out the observations of Dr. Combe when he observes of those who have been insane: "They remain in such a state of susceptibility that the slightest causes give rise to relapses, and they only preserve their sanity by continuing to live at home, where no mental agitation or inquietude, no unfortunate contingency, is liable to occur, and throw them back to their former state." Other writers have corroborated this opinion. Admitting that many of the operations of insanity are very closely identified with those of vice, how, in such a case, is the responsibility to be determined? If the acts be regarded as indicative of returning mental unsoundness, in how much do they appertain to crime, how much to insanity? In all such cases the inquiry first arises as to whether the circumstances attending the particular act under consideration were likely to reproduce the psychopathic condition on which the individual's insanity had previously depended; an important element in such an estimate being the time which had elapsed since convalescence was declared. It next becomes requisite to investigate how far the character of the act responds to the presumed mental condition. On the first query, it must be

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distinctly understood that as the possession of great abilities is no guarantee for the exercise of sound discretion, so the folly and vice displayed in any act or succession of acts cannot of themselves be received as indications of insanity. On the second query, the many difficulties which have been stated as investing the association of the particular act and mental state perplex inquiries. For the appreciation of such cases, the records of medical experience and the careful scrutiny of the physician should outweigh other considerations. We shall not attempt to suggest any rules for the guidance of those who may be called to their scrutiny, further than our previous observations afford, resting satisfied with recording the following opinion, to which, we believe, experience can add nothing: "In every criminal case where the question of responsibility arises in the course of judicial inquiry, if it be possible to establish any degree of positive insanity, it should always be viewed as a valid plea for a considerable mitigation of punishment, and as a *primâ facie* evidence in favor of the prisoner; and in no case where insanity clearly exists (without regard to its nature and amount) ought the extreme penalty of the law to be inflicted."[64]

We have drawn a distinction between acts resulting from such a deficient regulation of the mind as rests within the individual direction of the will, and similar acts originating from mental conditions beyond the control of the will. We may have in these opposed cases identical results as regards special crimes, proceeding from widely different causes. In one the individual acts, in the other he is acted upon. In both is a closely similar mental condition produced, since in neither is the power of self-regulation wholly lost, though in each it is perverted from its proper and healthy course. In the former, evil passions prevail over acknowledged obligations; the sense of enjoyment in immediate gratification placing in abeyance or surpassing the consciousness of its impropriety, crime results because the suggestions to its committal are presented to a mind whose energies are weakened, powers of resistance impaired, and tone vitiated by evil. In such a case, by withdrawing the temptation from without, and, through the adoption of physical and mental discipline, arousing the sense within, the mind may be restored to that vigor of action characteristic of health. With some individuals, exhortation

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and remonstrance, by awakening new desires, place thereby motives of a higher order in successful opposition to natural or depraved appetites; the moral sense regains that supremacy which it had surrendered. In others, in whom the animal nature prevails, the infliction of personal suffering is requisite in order that their vitiated mental sensibility, acted on through their organism, may, in a sense of physical restraint or pain, find an adequate, though less worthy, motive for reform. In cases of this nature the capability of self-regulation exists, a distinct sense and consciousness of crime is present, but evil passions prevail. The moral faculties, ceasing to respond to the dictates of conscience, lose that direction which had hitherto guided them: the inducements to crime, acquiring increased power, prove adequate to subdue the intelligence for their fullest gratification, and, as a consequence, deliberate criminality results. The habit of evil once established, its progress is rapid; cunning directs the consciousness of responsibility, though recklessness denotes the abandonment of moral guidance: profligates glory in their shame and preserve a consistency in their infamy. Such a mental condition is not one of health, not one of soundness, in the true signification of the term, but indicative of a degenerate, depraved, abandoned disposition, where vice holds the position of disease, consequent on which the passions subdue the judgment, and not infrequently wholly disarrange the several faculties essential for its formation. The prevention and correction of such mental conditions are the objects of legislation. The well-being of society and the safety of the community demand that the fullest responsibility be attached to this self-induced state, this voluntary abandonment to evil, so long as the capability of directing and controlling his actions appertains to the transgressor.

The fact which Casper, Esquirol, and Pinel have established —that moral prevail over physical causes for the production of insanity—affords a deeply interesting subject for inquiry, as leading to the inference, which experience too sadly verifies, that it is through the moral or affective faculties the early indications of insanity are most frequently evidenced. Therefore it happens that so many cases of confirmed disease come under the notice of the physician, in which for treatment much valuable time has been lost, and in the association of

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which no small risk has been encountered. Let a man be wicked, vicious, criminal; violate decency, live in profligacy, outrage society, as many are too often shown on their trials to have done; relations will still forgive those errors, for which their affection devises excuses and their self-interest plans concealment. They will attribute such conduct to wildness, weakness, or folly; admit the depravity of disposition which they deplore, the abandonment of principle from which they suffer, and in sorrow endure the infringement of every social rule which renders the domestic hearth a scene of perpetual misery and wretchedness. This they will not receive as evidence of insanity. Infamy rather than infirmity. There is something horrible in saying that one is mad. It runs in families. It will injure the prospects of the other members. Insanity is not a disease, but some vague, mysterious, intangible embodiment whose existence every one seeks to deny, in the expectation that oblivion will receive the evidence it has afforded when time removes those traces it has left.

It may appear, nay, it has been asserted, that notwithstanding this feeling there is a growing disposition to shield criminality beneath the plea of insanity. Several circumstances have conspired to favor this opinion. These circumstances rest in the marked increase in the number of the insane which late years have witnessed, and the juster estimate of the psychopathic relations of crime which their closer study of mental diseases enables physicians to form. The former is confirmed by the records of the various asylums throughout the United Kingdom. The latter especially bears out the observation of Dr. Pritchard, who some years ago thus wrote: "We doubt not that the time will come when the very names of many offences against decorum, now considered punishable crimes, will be erased from the statute book; and when persons now liable to be sentenced to the pillory or the gallows will be treated as lunatics." Real, practical benevolence finds in the application of medical truths additional incentives to commiseration, if not sympathy. In their appreciation of the illegal acts of the insane, standing between the violated law and an outraged community, the psychopathic physician has on the most important trials been compelled to listen to strictures on his evidence, tantamount in many instances to imputations against his integrity, from individuals whose posi-

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tion demanded that, if they did not promote, they at least should uphold, those principles of justice which the testimony of the physician has, in the exposition of insanity, so frequently preserved inviolate. We do not contend for the infallibility of medical men. Were we to do so, we should reject the evidence which many of the most important trials of modern times afford; when matters of fact become converted into matters of opinion, the value of the latter varies according to the capability of the individual forming it. Medical science, while rejecting fixed rules, is dependent on just principles, whose cultivation and application rest in the anxious and earnest study of each healthy as well as morbid vital process.

It is this study which enables the physician not only to distinguish the nature of any disease which may be present, but also to determine if deviations from the normal processes are to be regarded as indicative of morbid action. In psychical, as in physical diseases, attempts at imposition will be observed. Notwithstanding the assertions of Georget, Haslam, and others, that "to sustain the character of a paroxysm of active insanity would require a continuity of exertion beyond the power of a sane person," or that "no person who had not made the insane a subject of study can simulate madness so as to deceive a physician well acquainted with the disease," instances are on record, in which, for the escaping of just punishment, such a deception has been successfully carried out. We may especially direct attention to the following example. "A case is recorded of a young shepherd, named Specht, of previous good health, lively manners, and great intelligence, residing at Hegelensheim, on the upper Danube, who, having violated and shot a young girl, avowed his crime, and declared that the devil had incited him to do it. Next day, when brought before the magistrate, he seemed to have lost every physical and mental faculty; he could not stand without a great effort, and only answered in incoherent and isolated words. He pretended to be deaf and to have lost his memory, could recognize no one, and afforded no satisfactory answer to any interrogatory. MM. Windler and Zinc, the experts employed to examine into the state of his mind, were both of opinion that the condition was simulated, inasmuch as the degree of imbecility he pretended to exhibit could only be congenital, and there was no example of a person of such excel-

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lent parts as he possessed prior to the occurrence becoming suddenly imbecile: for imbecility that is not congenital only comes on and increases gradually. The prisoner was watched for fourteen months, and various plans tried. He still continued the same. The medical men maintained their opinion. He was then sentenced to three years' imprisonment, and, on returning to his cell, he threw off the imposition and leaped for joy. He had been advised to feign insanity by a fellow-prisoner."[65] This remarkable instance confirms the opinion of Ray, who differs from the authorities last quoted, in the assertion that "nothing requires a severer exercise of a physician's knowledge and tact than a case of simulated insanity." For the detection of such cases, the same principle of successive observation which seems to have so truly guarded the opinions of MM. Windler and Zinc promises the surest safeguard against error.

We might proceed at greater length to draw distinctions between that unsoundness of mind or mental condition in which vice prevails and that unsoundness of mind which results from disease, and adduce many examples in which the practical similarity between the two enveloped in the greatest obscurity their essential difference. Enough on this point has been already written. We cannot rationally expect that the passions of man will ever be so completely subjected to his reason as to enable him to avoid all the moral and physical evils which depend upon his own conduct. Crimes have, therefore, been measured by the injury done to society, and thus it occurs that a vast amount of moral guilt is suffered to pass unheeded, simply, as it appears, because its operations are limited in their pernicious consequences to the individuals immediately involved in its participation. When, however, aggression ensues, morality, awakened to a sense of personal safety, becomes invested with power and transmuted into law, consequent on which the penalties of such practices are enforced.

For this object, the system of British legislation which intrusts to the deliberate judgment of an impartial jury, guided and directed in their deliberations by the calm experience and disciplined mind of a judge, the honor, interests, and life of the community, is admittedly unequalled. When circumstances arise demonstrative of the defects in the practical operation

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of that system, it becomes not only the privilege, but also the duty, of each one to discuss without prejudice, that they may determine without passion, on the nature of the error present and the means most suitable for its removal. Public opinion needs but to be directed into the true channel, the public mind being possessed of a code of innate jurisprudence, of which our natural sympathies will ever continue to be the best conservators. To the inculcation of just legal and medical principles must we therefore look for the surest preservative against a repetition of those errors in judgment which have led to the condemnation of insane offenders—events that, when the excitement attendant on their execution has past, bear neither the test of calm reflection nor philosophic scrutiny.

To increase the difficulties of expert evidence, curious phases of medical opinion are occasionally manifest. A disposition arises for subtle analysis of unusual forms of mental disease, when not unknown combinations are treated as something entirely new, and, receiving fresh names, paraded as discoveries, rather than illustrations, of psychopathic science. Thus Professor Proust, in a lecture before the Académie des Sciences in Paris, has pointed out cases of double mental personality, in which epilepsy and hysteria, aggravated, if not induced, by cerebral injuries, have resulted, as it were, in a dual existence—virtuous one day and vicious the next.

M. Canot, at the Salpétrière, and M. Henri de Purville, in a recent number of the "Journal des Débats" on amnesia, or loss of memory, detail examples of somewhat similar alterations in character and feeling. Many might be disposed to accept such vicarious conditions as explanatory "of sudden and unreasoning crimes," for which no more practical causes immediately present themselves. To those, we would repeat the words of one of the greatest medical philosophers of the present century:

"Now, to believe that medicine has been brought to its greatest possible perfection would seem opposed to all analogy and probability. It is a science of observation and induction, but dealing with phenomena of which some are constant, others varying, presenting new characters and infinitely various combinations.

"Hence the necessity for an eclectic system, or that which seizes on the true, of whatever time, or from whatever source

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it comes, arranges all the facts within its reach, and modestly admits its incapability of explaining many things, of the existence of which it entertains no doubt."[66]

These observations are to the psychopathic student encyclopedic in their teaching.

In concluding our inquiries on the important subject of "unsoundness of mind in its legal and medical relations," we may observe that in its investigation our great object has been to point out difficulties rather than to offer rules. We have wished to identify law and physic for the purpose of justice—to preserve them separate for the furtherance of truth. Justice demands on the part of law that the criminal be punished. Truth requires from justice that the insane be held, as regards the law, irresponsible. The object of both the lawyer and physician must be regarded as being, for the purposes of justice and truth, identical, even though the principles directing the practical application of their several sciences be different. At no period was it of more importance that the awakened intelligence of mankind, which on all sides is active in the pursuit of knowledge, should know and feel that medical science, despite the difficulty, if not obscurity, investing its practical elucidation, is still, in mental as in bodily derangement, the instrument which should guide our proceedings, either for the restoration of individual health or the preservation of public safety.

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BALDNESS AND GRAYNESS;

THEIR

Etiology, Pathology, and Treatment.

BY

TOM ROBINSON, M.D.

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BALDNESS AND GRAYNESS.

CHAPTER I.

ANATOMY OF THE HAIR.

The Human Skin.

Before proceeding to the structure and functions of the hair, we must premise some observations on the nutrient soil in which the hairs are implanted, namely, the skin. The outer covering of the body, having to serve at once as a protection for the more deeply-seated structures and as an organ of tact, touch, secretion, and excretion, is necessarily not only a very compound tissue, but also a very complex apparatus.

The skin mainly consists of two parts, viz.: the true skin (cutis vera or corium, derma) and an external layer named the scarf-skin (cuticle or epidermis). The true skin, which rests upon a layer of fatty and cellular tissue, strong, tense, and tough, is nevertheless highly elastic and yielding, and being composed of fibro-cellular tissue, interwoven in all directions, numerous spaces or areolæ are formed, which, in the deeper layers of the skin, usually contain little masses of fat. The surface of the true skin is beset with small eminences named papillæ, which appear chiefly to contribute to the perfection of the skin as an organ of touch, as we find them highly developed in parts where the sense of touch is exquisite, as on the hands and fingers.

The glands of the skin are of two kinds—the sudoriparous, or sweat glands, and the sebaceous, or oil glands. The sweat glands exist in all regions of the skin, but they are not equally abundant everywhere. Each sweat gland is supplied with a number of capillary vessels. The total number of these sweat or perspiratory glands has been estimated at nearly two millions and a half. Besides the perspiration, the skin also se-

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cretes a fatty matter by the sebaceous glands before mentioned, which exist in all regions of the body, though not equally numerous in all parts. The skin thus constitutes a vast emunctory, by which a large amount of fluids and gases is eliminated from the body.

The epidermis, cuticle, or scarf-skin, forms a protective covering over the true skin. It is non-vascular and insensible. The thickness varies in different parts of the surface from $\frac{1}{12}$ to no more than $\frac{1}{210}$ of an inch. It is thickest in the parts much exposed to pressure. The cuticle is made up of flattened cells agglutinated together. Many of these cells contain pigment granules, which are contained principally in the cells of the deep layer, called rete mucosum, or mucous web. Thus, the color of the skin of the Negro, the European, and other races, owe their shades to the intermixture of the pigment cells in different proportions in the respective localities of their scarf-skin. Generally speaking, according as the pigment cells are more limited to the lower surface of the Malpighian tissue, or are more massed together in an upward direction, so will probably the darkness of the skin proportionately increase. A Negro child is not born black, but of a nut-brown color. The full color does not, according to the late Pruner Bey, appear till the end of the first year in the Soudan, and only in the third year in Lower Egypt. (Vogt: "Lectures on Man," edited by Dr. Hunt. Anthropological Society's Publication.)

The Muscles of the Skin.

The muscles of the skin are, as is well known, of two kinds, the unstriped, and the striped variety. The latter presents, under the microscope, transverse striæ, which occur in all the muscles usually termed "voluntary," although not limited to these alone. These striated, or striped muscles, may be detected in the face, forehead, and nose. The non-striated muscles, which are far more abundant, are found to be connected with the hair follicles, and are called erectores pili (erectors of the hair). They exist in bundles, either on one or both tiers of the hair follicle, and they also more or less inclose the sebaceous glands.

The hairs are modifications of the cuticle. They are found

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on nearly every part of the surface of the body, excepting the palms of the hands and the soles of the feet.

A hair consists of a root which is implanted in the skin; a shaft or stem, and the point. The root of the hair swells out at its lower end into a bulbous enlargement, which is received into a recess of the true skin, named the hair follicle which, when the hair is of considerable length, reaches into the subcutaneous cellular tissue. The hair follicle receives near its mouth the opening ducts of one or more sebaceous or oil glands, and consists in structure of an inner or dermic coat, which is continuous with the skin, and an epidermic lining continuous with the cuticle. The outer coat is highly vascular, and is abundantly supplied with minute nervous filaments. When a hair is plucked from its follicle, the cuticular lining, or its inner coat, commonly adheres to it, forming what is called the root sheath. The soft bulbous enlargement of the root of the hair is, by its base, attached to the bottom of the follicle, and this part of the follicle, which is in reality a part of the true skin, although sunk beneath its surface, supplies the material for the production of the hair. There is, at the bottom of each hair follicle, as Kölliker has shown, a vascular eminence, or papilla, similar to those found upon the surface of the skin, which is continuous with the dermic layer of the follicle, and being highly vascular, and no doubt supplied with nervous fibrils, is subservient to the growth of the hair. The papilla must therefore be looked upon as the most important part of the hair.

The shaft is covered with a coating of fine scales, covering a fibrous substance, which in most cases forms the chief portion, if not the whole, of the shaft. In many hairs the centre is occupied by a different substance, named the medulla, or pith, in which case the surrounding fibrous part is often called the cortical. The length and thickness of the shaft vary greatly in different individuals and in the various races of mankind, and also in the different parts of the body. The shape of the hair shaft has been differently described by different authors, so that Leuwenhoek, the microscopist, said, "in many hairs as many shapes" (quot crines tot figuræ). Modern researches have shown that the human hair is seldom round, but rather flattened, so that its section appears oval or kidney shaped. The diameter of the hair has also been variously

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stated. It varies according to locality and age. Beard hair is from $\frac{1}{251}$ to $\frac{1}{300}$ of an inch; head hair, $\frac{1}{400}$, $\frac{1}{600}$ of an inch from a little child. The curliness of the hair depends, according to Weber, on its flatness; the flatter it is, the more it curls. The strength of hair depends upon its length, thickness, and flexibility. The microscope has, in short, revealed the fact that the hair is not perfectly cylindrical, nor a tube, as was long believed. Except at the base, into which the pulp enters to a variable distance, the hairs are perfectly solid. The surfaces of the hair are not smooth, but laminated—the laminæ being placed over each other in a slanting direction, like the scales of a fish. Hence, a hair drawn between the fingers from base to tip moves smoothly, but by reversing the motion the roughness will become perceptible.

The beard and all short curling hairs are flattened, and flatness and curliness are in direct proportion. Both attain their maximum in the Negro. The medullary substance (medullary canal) is not regularly met with in all hairs. This constituent is absent sometimes in head hair, and almost constantly in woolly hair. In dark hair this substance is only seen after long hair has been bleached by diluted nitric acid. The medullary substance may be isolated by boiling the hairs in caustic soda, and tearing them. Falk and Henle asserted that no medullary canal is met with in the hair of children under six years. Oesterlin ("Das menschliche Haar," O. Oesterlin, Tübingen, 1870) denies this, as he had found it in the hair of children of only two years old. Oesterlin also dissents from Pfäff, who considers the medullary strand as the chief carrier of the hair pigment. He agrees with Griffith, Mandl, Kölliker, and others, that the supposed black pigment is simply air, but where these air bubbles have their seat, and what is their physiological significance, is as yet an open question. The medullary substance, where it exists, is not always in the centre, but sometimes at the margin of the hairs, which is especially the case in flattened or triangular hairs. Sometimes, says Pfäff, the medullary substance forms in one and the same hair two pigment strands. The medullary substance does not in all hair form from point to root a continuous accumulation of cells, but there are seen at intervals cells which are filled with masses of the internal cortical substance, which by their texture form a marked contrast to the roundish cells

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of the medullary substance. Under these circumstances we cannot strictly speak of a medullary canal, as the medullary substance by no means fills the centre of the hair in its whole length.

The eyebrows have a length of about from two to three inches; they lie in an oblique direction above the orbits. Anatomists have divided the arches which they form into the head, the body, and the tail. The head commences at the root of the nose, and sometimes coalesces with the head on the opposite side. The body extends along the orbit and the tail terminates at the temple. The eyebrows approach more or less, and sometimes seem continuous. The individual hairs of the eyebrows are cuneiform, stiff, short, thick, and lustrous, terminating in a thin point. Whatever be the form of the eyebrows it necessarily depends on the form of the orbital arch of the frontal bone; the more gentle the arch toward the temple, the more pleasant its form.

The eyelashes (cilia) are like the hair of the eyebrows, short curved hair. They are arranged in two or more rows along the edges of the eyelids at the line of union between the skin and the conjunctival mucous membrane. The lashes of the upper lid are both more numerous and longer than the lower. The hairs of the upper lid are curved upward, those of the lower curved downward. The rows of the cilia vary; there are sometimes four rows in the upper eyelid. Both the cilia and the supercilia are distinguished from the rest of the hair by the definite degree of their growth, by their slow reproduction which, when they are cut, is not effected until the lapse of two years to recover their previous length. Finally, the eyelashes rarely become gray, and moreover, proceed by way of exception, straight from the skin; all the rest take a slanting direction, more or less. This is best seen in the crown of the head.

Number of Hairs.—As already stated, the hairs are unequally distributed on the human body. In most cases the head is the most hairy part. Withof found in a moderately hairy middle-aged man, in a quarter square inch of the top of the head (vertex) 293 hairs, on the back of the head (occiput) 225, and on the front part (sinciput) 2,111; on the chin 39. But the numbers vary considerably, according to age and color. Upon the surface of a quarter of an inch Withof found

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black hair, 147; brown, 162; and blond hair, 182. It seems, therefore, that black are the thickest, and blond the thinnest. The number of hairs on the face, whiskers, beard, and mustaches, varies greatly in races and individuals.

Weight.—The weight of the hair naturally depends upon its length and thickness. It is rare that the head hair weighs more than 12 ounces, although in a few instances it has been found 14 and 16 ounces. Absalom's hair "polled" once a year is said to have weighed 200 shekels; according to Geddes 112 ounces.

Hair Intermediate.—Oken observes that the hair formation forms the connective link between animal and vegetable tissue. His words are: "The fur is the peripheral connection between the plant and the animal. The hair forms the summit of the vegetables. As the plant requires air and light, in the animal kingdom the hair appears where it is most exposed to those elements, namely, on the surface. It is not a little remarkable that those mammals which stand nearest to men, the anthropoid apes, are distinguished by their great development of the capillary system."

The ancients appear to have had a fair knowledge of the structure, growth, and use of the human hair. Pliny (Lib. XI., c. 94) says: "The hair of man is partly born with him, and partly produced after his birth. The hairs that issue from a thick skin are coarse. When cut, the hairs shoot out from the place where they have been cut, as is the case with grass cut at the root. The hair also grows quickly in certain diseases, especially in phthisis, also on the body in old age."

As regards the eyelashes, Pliny observes (L. XI., c. 59): "Man has lashes on the eyelids, and women daily stain them to add to their beauty. Nature, however, has provided the hair of the eyelashes with another view—as a protection of the sight against the approaches of insects and other objects."

The nails are, like the hairs, growths of the cuticle, with this difference, that the uppermost or horny layer, which forms the actual nail, is more developed. The posterior part, which is hidden in the groove of the skin, is the root, the uncovered part is the body terminating in front by the free edge. That portion of the nail near the root which is whiter than the rest, is from its crescent shape called the lunula. That portion of the skin to which the nail is attached, and by which in fact it is generated, is called the matrix.

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The growth of the nail is almost, like that of the hair, effected by a constant generation of cells at the root and under surface. In consequence of the addition of new cells at the posterior part, the nail is made to advance, and by the opposition of similar cells on its under surface the nail grows in thickness. The nails, like the hair, grow more in summer than in winter time, and they also appear to differ in each finger.

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CHAPTER II.

PHYSIOLOGY OF THE HAIR.

Growth and Development.

It is about the end of the third month of intra-uterine life that the hair begins to form, when it appears in the shape of minute black spots beneath the cuticle. At the period of birth, the head hair varies in length from one to four centimetres. As occasionally infants are born with teeth, so are there sometimes babies born with a "shock head" of hair. Commonly, the hair is very scanty at this period, and only thickens toward the end of the first year. The dimensions which the hair acquires at a later period greatly vary, according to the constitution, sex, race, and descent of the individual. It is well known that the female hair attains a greater length than that of the male. Grellier ("Dissertation sur les cheveux," Paris, 1806) supposes that this is owing to the greater abundance of cellular tissue beneath the scalp, so that the hairs find on the female head a more congenial soil for their nourishment and development, while Dr. Lewis Grion attributes the difference in the two sexes to the accumulation of electrical excitants in the female. Numerous cases are recorded of ladies whose hair reached the length of six feet, and swept the floor. The writer of this treatise saw a few years ago a young lady promenading at Yarmouth jetty, rejoicing in a *bona fide* crinal appendage more than five feet in length. The mean diameter of the hair is, according to E. H. Weber, 0.04 of a line. This diameter depends chiefly upon the color of the hair. A square inch of scalp contains, according to Withof, 5,072 black, 608 brown, and 790 fair hairs. The number of hairs upon the head will therefore vary according to their hue, and it has been found that while a flaxen-haired beauty has from 140 to 150,000 hairs on her head, a black-haired belle has only from 100 to 110,000, while a red-haired one has only about 20,000 hairs on

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her head. The hair possesses great power of resistance, and is capable of supporting a greater weight in proportion to its volume than most of the fibrous substances. Weber says that a hair ten inches long is capable of being extended one-third of its length, and this elasticity is so great that after being elongated it recoils, and is but $\frac{1}{18}$ longer than it was before the traction.

Microscopic observation has revealed the important fact that the capacity of absorption and excretion possessed by the hair are about equal, and that the reciprocal action of the air and the living organism is not merely effected by the skin and the lungs, but that the hair plays a by no means unimportant part in the process. In baldness, the hair has lost its excretory and absorbent canals. The harmony of the animal economy is disturbed, hence the organs, the skin, and the kidneys perform vicariously the work of the hair. The scalp perspires much more than before, and a sediment in the urine is found (for a considerable time) which was not to be observed previously to the loss of hair.

Hair as an Organ of Tactility.—Mr. Jobert in a communication to the French Academy, gives the result of his researches on the tactile faculty of the hair in different regions of the face. It is well known that in many mammals the hairs form a tactile apparatus of exquisite sensibility. He found that in man, the eyelids are provided with numerous nerves presenting very remarkable connections with the follicles of the eyelashes, so that the latter possess tactile facilities. The skin of the cheek bones, of the wings of the nose, of the lips and the chin, also possess hair with a nervous apparatus, though in a lesser degree than those of the eyelids. The nerves, frequently accompanied by blood-vessels, always enter beneath the sebaceous glands. The numerous connections of the nerves with the hair follicles force us to accord to these small organs a certain importance in appreciating the sensation produced by certain external objects, especially the movements of the air waves.

Transplantation of Hair.—Tieffenbach in his dissertation "Nonnullæ de regeneratione," 1882, says that hairs may be transplanted from one organism upon another. He inflicted upon his own arm with a puncture needle, several punctures, and inserted six superciliary hairs taken from a friend. Of

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these six, two became fixed, two dried up and fell out, while two were expelled by suppuration. This suggested to him the artificial implantation of lost eyelashes, in which he several times succeeded. By transplanting some of his own head hairs on his arms, they became fixed, and the roots became strong and thick. Even of the white hairs of an old man, one became fixed.

Temperament.—The mental disposition, and even the psychical strength is believed by many to be indicated by the hair. Black, curly, and stiff hairs are said to indicate a melancholy temperament; fair hair, a sanguine or phlegmatic temperament; and red hair, either a very cunning, or a very good character. Hence it was said we meet in prisons with many red-haired women, and black-haired men; rarely with fair-haired criminals. Yellow or red hair is rarely found among maniacs. Very red hair sometimes indicates a scrofulous disposition. All this is, of course, subject to so many exceptions that it is scarcely to be relied upon.

The chemical composition of hair is nearly allied to that of the other horny tissues of the body, such as the cuticle and the nails.

Hair consists of carbon 49 to 50 per cent; hydrogen, 6.66; nitrogen, 17.93; sulphur from 3 to 5 per cent; oxygen, about 21 per cent. These quantities vary according to color and other circumstances. Thus Bibra found in some specimens of red hair, the oxygen to amount to nearly 8 per cent.

Hair is indissoluble in water. Nitric acid turns it yellow; hydrochloric and sulphuric acids dissolve it, forming rose-colored solutions. Many salts and metallic acids and also some organic substances change the color of red or white hair to black. A solution of nitrate of silver in ether, or the same salt mixed with lard, oil, slaked lime, or pyrogallic acid is frequently used for blackening the hair.

Does the hair grow after death? Opinions are divided. Old Heister ("Compend. Anat.," 1741), denies that the hairs grow after death, as he had convinced himself by experiment (sicut certo experimento edoctus sum), while Dr. P. Rommelius ("Ephem. Nat. Curios.," Dec. 11, Ann. VI.), is as certain that they do. Rommelius (obs. 226) records the case of a healthy strong peasant with green hair. He also gives cases of green sweat. In Ann. VII., obs. 155, we find the case of an old man

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of Kiel, whose hairs on the head were green. Borellus (Cap. II., obs. 56); Bartholinus, Essert, and others, all speak of green and blue hair, which are now generally ascribed to metallic vapors.

To a certain extent the hair has an independent life. The growth of the hair after death has been, as is already mentioned by many physiologists, held to be fabulous. On the other hand, Villerme ("Dict. des Sciences Médicales," Tom. V.), Bichat, and Puiset, insist upon the growth of the hair and beard after death. The latter gives the case of a father who, from affection, had kept the body of his son, and perceived that the beard after shaving had grown again. Bartholinus also relates that the cut-off hair of a corpse had grown up again yellow. In anatomical theatres, frequent opportunities must occur to observe the phenomenon.

When the parish church of Turvey, Beds, was undergoing restoration in 1854, a large stone was raised which some three hundred years ago had been placed over the remains of the Lady Johanna, wife of the second Lord Mordaunt. Her remains appeared in a shroud of yellow silk, which retained its color and firmness. Her dark auburn hair had grown so much after death as to fill up the space around, and form a mould for the head ("N. and Q.," Vol. VI., 1870).

The following singular story appeared in Hawthorn's "English Note-book," Vol. I., 96: "The grandmother of Mrs. H—— died fifty years ago, at the age of 28. She had a head of beautiful chestnut hair. When the tomb was opened, in 1853, her coffin was found to be filled with beautiful glossy ringlets, into which her whole substance seems to have been transformed, for there was nothing but these shining curls, the growth of half a century, in her tomb."

In Sir Henry Halford's account of the opening of the coffin of Charles I., in 1813, it is stated: "The pointed beard so characteristic of the reign of King Charles was perfect. . . . The hair was thick at the back part of the head, and in appearance nearly black."

Most of the old writers believed in the growth of the hair after death. Aristotle ("Hist. an. Lib.," III., c. 11) says in the Latin translation: "Etiam in senectute et defunctis pili augentur, sed non nascuntur." "We also see that in old age and in the dead, the hairs grow, but are not born." There is scarcely

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any author of the middle ages who did not believe it. Garmann ("De Miraculis Mortuorum," Lib. I.) says that the hair grows after death on all bodies of young persons, or of such who died a violent death. "In such cases," he continues, "the nutrimentum capillorum remained in excess." There are, nevertheless, not wanting respectable authorities who utterly deny the growth of the hair after death. Ruysh ("Thesaur.," IX., says: "Sepulcra intravi et nunquam contrarium observavi. . . . Vide nec capillos crevisse nec ungues post-mortem," etc. "I have gone into the graves, and have never observed the contrary. We may see that neither the hairs nor the nails grow after death." Among the modern writers we find that Haller ("Elem. Physiol.," § 18, T. V.) declares the phenomenon to be an illusion. Garmann ("De Miraculis Mortuorum," Lib. I., tit. 1, § 7) says that the hairs of criminals who were hanged in chains became gray. Similar instances are given in "Ephem. Acad. Nat. Curiosorum."

Hair Standing on End.—The Rev. Dr. Andrews, of Beresford Chapel, who had been requested to attend William Probert, who had been concerned in the murder of Weare, for which Thurtell was hanged in 1824, writes that "on the morning of execution the culprit seemed anxious to listen and to join in the prayers. On leaving the cell, and going to the room where he was pinioned, he became excited, and the instant the executioner put the cord to his wrist to bind his hands, his hair—long, lanky, weak, iron-gray hair—arose gradually, and stood perfectly upright for some time, and then as gradually fell down."

That these phenomena are the results of fear and horror has been known for ages. Job iv., 13, 14, 15: "The hair of my flesh stood up." But it was not known that the hair follicles are provided with muscles and nerves. The muscular fibres are, by nervous influence, caused to contract, the follicle is protruded, and the hair it contains stands erect. The same effect may be, as is well known, produced by electricity. Cold as a physical agent, and listening to a horrible story, as a moral agent, will produce what is called a "goose-skin," which is simply the result of the contraction of the muscular fibres.

The epidermic coat of the follicle adheres so closely to the root of the hair that it commonly separates therefrom when a hair is pulled out. It is hence frequently called the "root-

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sheath." It consists of two layers; of an outer more compact stratum; and an internal more transparent layer. The outer root-sheath corresponds with the mucous layer of the epidermis, and contains soft cells, including pigment granules, which can be distinctly seen in the follicles of the skin of the Negro. The inner root-sheath forms a firm, transparent yellowish membrane, extending from near the base of the hair follicle, and near the mouths of the sebaceous follicles, where it terminates abruptly. It appears to be a homogeneous membrane, but when it is very closely examined, it is found to consist of two or three layers of cells. The outermost layer (Henle's layer) consists of long, flattened, non-nucleated cells. The innermost next to the cuticle is known as Huxley's layer, and consists of one or two layers of shorter and broader polygonal cells.

Rate of Growth of Hair.—According to Krafft ("Novi Commentarii"), the growth of the head hair amounts in the year to two and four-ninth inches. Withof ("De Pilo Humano") says it grows four inches within a year. Haller computes the growth at four and one-half inches within twelve months.

The experiments made by these physiologists did not apparently rest on strictly scientific principles. Berthold is of opinion that the growth of the hair might be best observed in females who have lost their hair in consequence of a fever. He found in such cases that in young females, say from sixteen to twenty-four, the hair grows at the rate of seven inches in twelve months. The growth of the hair is greater in summer than in winter, and more copious during the day than during the night.

Shedding of the Hair.—Kölliker affirms that after birth, a total shedding of the hair takes place by new hairs arising in the follicles of the downy hairs, and gradually displacing the old ones. He also thinks that in many children the hairs of the head fall out from two to six months after birth, and are replaced by new ones. As in the earliest periods of life, the cast-off hairs are replaced by new ones, so we find something similar occurring at a later period, and it is quite certain that during the vigorous period of life, there is a continual replacement of the numerous hairs which are shed. When the hairs which have fallen out after a severe illness are re-

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produced, it is more probable that they are developed in the old follicles than that they are entirely new formations; since, according to E. H. Weber, the follicles of cast-off hairs continue to exist for a long time.

Nutrition of the Hair.—The mode of nutrition of the hair may be observed by taking from a body, a piece of hairy skin and examining by means of a microscope the subcutaneous tissue. All around the bulb, we see the finest loops of the capillary blood-vessels, and also offshoots of capillary vessels, which are imperceptibly lost near the hair bulb, and form no doubt the intervening link between the soil and not only the plant, but also the medium between the atmospheric, electric, or maybe miasmatic conditions of the external world with the organism. Analogous to the capillary vessels, the most delicate nervous plexuses send processes to the bulb. True, the human eye as yet has not been able to follow these nervous threads, but that they reach the bulb, there can be little doubt. The pain on pulling the hair decides this. We are aware that the least highly-organized tissues are capable of being reproduced, after having been destroyed. Cases have occurred that when the original stock has been destroyed in the scalp, a new stock may be developed by the powers of nature, and that an entirely new crop of hair arises, and so it is with the teeth. Dr. Curran related to Dr. Graves that Mrs. Waterworth, Curran's grandmother, who died aged 95, when about 80 got a complete new set of teeth. In Easton's work on longevity, particulars are given (from manuscript) respecting one Mary How, of Mapleton, Derbyshire, who at the age of 110 got several new teeth, while her hair resumed its former color. John Minnerker, of Maryport, Cumberland, had such an abundant crop of new hair between his 80th and 112th years that twenty wigs were made of it during that period.

Permeability of Hair.—Physiologists agree that the hair consists of matter somewhat analogous to horn or nail. For practical purposes, we may consider the hair to resemble a plant imbedded in the surface of the body, and consequently its healthy or diseased functions must be connected not only with changes occurring in the hair and its bulb, but with those which take place in structures more immediately in contact with the latter. Thus, the hair may cease to grow, and baldness ensue, as in old age, from decay and absorption

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of the bulb itself, or the same result may in youth be produced by causes which injure the vitality of the bulb or change the structure of the skin in which it is implanted. The fully-developed hair, although destitute of vessels, is not a dead structure. The vital changes, says Kölliker, going on in it are as yet shrouded in obscurity, but we may be assured that it is permeated by fluids, and employs them for its nourishment and maintenance. The hair must therefore be regarded as endowed with life, and dependent in a certain way upon the entire organism, not upon the skin in particular. The falling out of the hairs certainly depends in many cases merely on the want of the necessary natural material. The whitening of the hair is doubtless partly to be referred to the same cause. The well-authenticated cases of the hair rapidly becoming white are interesting, and speak strongly for the vitality of the hair, although it is not yet known what peculiar processes in the elements of the hair occasion the decoloration.

Transpiration of the Hair.—It is a very old idea that the hairs act as flues which carry off noxious vapors from the head (Galen, "De Usu Partium," cap. 19, de pilis). In fact, all physiologists who were unable to indicate a special use of the hair assigned to it an excretory function. Haller believed that the hairs transpire at their points, and perhaps at their whole surface. Fourcroy thought that the use of the hair consisted in excreting an excess of phosphoric acid, which led Vauquelin to assert that the hair in various animals assumes the functions of urinary organs. This much seems pretty sure, that the hairs are subservient to the excretion of some substance either in gaseous or liquid form. It is because the hair possesses partly the function of transpiration, that it became the carrier of a contagion. Hence in cases of pestilential diseases, the greatest watchfulness is requisite at the introduction of hairy and woolly materials. That the hairs possess the power of condensing, so to speak, the electric fluid, and must be considered bad conductors of electricity, is certain; and insomuch as electricity plays an important part in all vital processes, the function of the hair certainly deserves greater attention than it has hitherto obtained from physiologists and pathologists. We know that the shaft of the hair is normally insensible, and may be cut, twisted, fixed, and bent in every direction, without giving rise to any sensation; neither does

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the shaft possess any independent motion. Under certain conditions, nevertheless, it seems to acquire both. Thus the hair, as we know, becomes erect under certain emotions, as well as under the action of electricity. That the erection arises from the action of the skin or the bulb is certain; but the question is whether the movement in the shaft be entirely passive, or whether the fluid be accumulating in the cellular tissue similar to that of the blood in erectile tissues.

That the hair is both idioelectric and hygroscopic is well known. Long ago Dr. Bridone obtained from hair by mere friction sufficient electricity to kindle spirits of wine, and several cases are cited of persons whose beards and hair became luminous when they were in a great passion. A singular case is reported by Dr. Lodere of a young man who among his black hairs had a tuft of dark red hair which turned scarlet, like the crest of a cock, when he was in a passion.

Hairs being hygroscopic, they readily imbibe and give out moisture, and become longer or shorter according to the state of the atmosphere, and hence their employment as the barometers seen in toy shops.

Nerves. — Dr. C. Arnstein ("Sitzungsberichte," Vienna, 1876), in a lecture "On the Nerves of the Hairy Skin," found in the human hair, especially that of the head, very frequently nerve-fibres in the sections, so that he does not hesitate to affirm that every hair is provided with a nerve. He also found the feather-bags of birds provided with nerves.

That the hair of albinos differs chemically from normal healthy hair, has been proved by Sachs. He found that 500 grains of his own yellowish-white hair produced only from one to two grains of ashes which gave lime, 0.368; magnesia, 0.75; no iron and no silica, while a limited quantity of black hair produced 37 grains of ashes, which yielded 2.116 of lime, 0.9 of magnesia, and 0.2 grains of oxide of iron. King Hystaspes is said to have had a daughter of the name of Charidea, whom he would not recognize as such, because she had a perfectly fair skin and white hair. According to Pliny, Albania has received this name from albinism being endemic in that country.

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CHAPTER III.

COLOR AND TEXTURE OF THE HAIR.

We have seen that the color of the skin resides in the epidermis or cuticle, so that the various shades presented by different races and individuals are due to the comparative amount and relative admixture of the pigment cells. In the same way the color of the hair depends on the amount of the pigment granules diffused through the cortical substance of the hair. Thus, to take an extreme case, the entire absence of the pigment globules gives rise to that anomaly called albinoism, or albinism.

Apart from the pigment granules, the air-vessels in the hair have recently much occupied the attention of microscopists, with regard to color, as will be found in another place.

With some exceptions, we find that as a rule, the color of the hair harmonizes with that of the skin and the iris, although it is not rare to find red-haired ladies with brilliant black eyes. Black is undoubtedly the predominant color of the human hair, and we consequently find it in all parts of the globe. Light hair with its various shades, from flaxen, light brown, chestnut, golden, to fiery red, belongs to comparatively few families of the human species, and these chiefly (though not exclusively) inhabit Europe and the colonies established by Europeans. In Europe we find dark hair, as well as dark complexions, gradually diminishing as we approach the north until we reach Scandinavia, where light hair is dominant. Further north the hair again becomes darker, so that the Lapps and Esquimaux have dusky complexions and dark hair. This applies also to the antarctic zone.

Excess of Pigment.—According to Heusinger, the pigment may be so abundant as to soil the hand touching it. Ladies in southern parts sometimes complain that their jet-black hair spoils their head-gear. Such cases are probably due to excessive transpiration.

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In a paper on the coloring matter in human hair, read by Dr. Sorby at the Anthropological Institute, the author described the mode by which the coloring substances may be separated. Although four different pigments have been obtained, Dr. Sorby thought that the general color of the hair is mainly due to black and brown red pigment, both of which may easily be obtained in a separate form, and used like water-colors, as shown by many drawings exhibited. All the various tints which the human hair presents were due to a variation in the total or relative amount of the red and black pigments.

That latitude, light, and heat influence to a considerable extent the color of the skin and hair is undeniable, wherefore we find the deepest shades of black chiefly near the equator, whether it be in Africa, India, or America, but neither temperature nor the rays of the sun can be considered as the sole factor in the production of the deep color of the skin and hair.

Hair as a Race Character.—The color of the skin and of the hair have always more or less fixed the attention of travellers and anthropologists with reference to the classification of the human species. Thus, as is well known, Blumenbach assumed five races according to their color: the black, brown, yellow, red, and the white race. Dr. Prichard grouped them under three varieties: the melanocomous (black-haired), the leucous, or white variety, and the xanthous, or light-haired. But the color of the skin and the hair are insufficient to determine the character of a race. The formation of the skull, the length, smoothness, curliness, crispness, and general disposition of the hair must be attended to. Geoffroy St. Hilaire comprises, as does Bory St. Vincent, all the white, yellow, brown, and red races under leiotrichi, straight-haired, and all the Negroes, Negritos, Hottentots, and Bushmen under the woolly-haired ulotrichi. The occurrence of crisp and straight hair depends on the whole organization.

Professor E. Haeckel ("History of Creation") thought that the conformation of the hair is nearly as important as the character of language in the classification of mankind. He accordingly assumes twelve species of man and their thirty-six races. Of these twelve species of man, the four lower species are characterized by the woolly nature of the hairs of their heads, every hair is flattened like a tape, and thus the

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section is oval. These four species of wool-haired men (ulotrichi) may be reduced into two groups, "tuft-haired" and fleecy-haired. The hair on the head of the tuft-haired (lophocomi) Papuans and Hottentots grows in unequally-divided tufts. The woolly hair of the fleecy-haired men (eriocomi), on the other hand, in Caffres and Negroes grows equally all over the skin of the head. All ulotrichi, or woolly-haired men, have slanting teeth, and the color of their skin and hair is always dark. They are more like apes than the lissotrichi, or straight-haired men. No woolly-haired nation has ever had an important history. In the eight higher races comprised as straight-haired, the hair may be much frizzled in some, but never actually woolly; each separate hair is cylindrical, not like a tape, and hence its section is circular, not oval. The late Dr. Pruner Bey, in his interesting essay on human hair as a race character, found on examining by the aid of a microscope the transverse section of hairs that they were circular in smooth; oval, rather compressed, in curly hairs; and elliptical and much flattened in crisp hairs. The more the hair is flattened the greater its tendency to curl; the more it approaches the circular form the smoother and stiffer it becomes. Considering that the smoothness, stiffness, and crispness constitute some of the most persistent characters in the types of mankind, it is in his opinion not altogether an Utopian idea that the problem may be solved—"given a human hair, to determine the race to which the individual belongs from whom the hair has been taken."

But while fully admitting that the structure and transverse sections of the hair form a chief character in the classification of the human race, I consider it rather hazardous to construct upon this single feature a complete system of classification. It is only when the cranial structure coincides with that of the hair that a more satisfactory classification would be effected, otherwise the smooth-haired Australians must be accounted of the same race as the straight-haired Mongolians.

The character of the hair, especially that of the head, may be described as coarse, fine, smooth, straight, curly, waved, frizzly, crimped, or tufted. With reference to the classification of human races, the form of the hair is certainly of more importance than the color. The form of its transverse section is sometimes circular, sometimes elliptical. This much is ad-

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mitted by all anthropologists, that in proportion to the flatness of the hair, especially if combined with great fineness, the greater will be its tendency to curl and become frizzly.

The curliness of human hair attains its maximum in the Negro. It is not merely curly, but the individual hairs are extremely fine, and the roots are much smaller and lie more superficially than in the other races. That this crispness does not depend solely on the heat of the climate is proved by the straight hair of races living in other parts of the tropics. The Esquimaux and the Greenlanders have black hair, as have also the inhabitants of Terra del Fuego.

Crisp hairs entwine themselves with one another more closely than those which are straight; hence Negro hairs are better for felting.

Among the variations of the human genus, there are some who, as regards the structure of their hair, present a very remarkable appearance. Such are for certain the Cafusos and the Papuans. The Cafusos, who are known to be descendants of an intermixture of the aborigines of South America with imported Negroes, present, as described by the German travellers Spix and Martius, a most striking appearance by the excessively long hair of their heads, which at the point is half-curled, and rises almost perpendicularly from the forehead about eighteen inches, thus forming a prodigious and very ugly natural peruke, which at first sight seems artificial. This conformation of the hair causes a resemblance of the Cafusos to the Papuans of New Guinea. These large bushy masses of woolly hair attracted the attention of early voyagers, such as Dampier, who called them "mop-headed." They are like the Cafusos or mixed races. They have neither the hair of the Negroes nor of the Malays, but hold a middle place between them. Their hair frizzles naturally, which gives to their head an unnatural circumference. They have very scanty beards. The Papuans are, as stated, chiefly remarkable for the peculiar growth of their hair, from which their name is derived, for papuwah or puapuah signify in the Malay language frizzled like wool. The growth on the head of these people, being very luxurious and crisp, forms a dense mop projecting from six to twelve inches from the skull. The hair of the Papuans has been generally described as growing in tufts, but Dr. Miklucho Maclay and Dr. A. B. Meger both state that the hair of the

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Papuans is as evenly distributed on the scalp as in the case of the Europeans, and that the matting into tails is the result of the hair not being combed. In point of thickness of growth of hair the Papuans probably surpass all other nations, just as the North American Indians seem unrivalled in point of length of hair. Catlin ("North American Indians," Vol. I., p. 49) says that the hair of the Sioux or Dacotas reaches to the heels, and in the Crowheads it attained a length of ten feet seven inches.

The evidence in favor of the inheritance of the color of the skin applies equally not merely to the general color and texture of the hair, but to certain apparently tufting peculiarities in the disposition of the hair which reappear in the descendant.

Change of Color.—The influence of disease on the color of the hair is a demonstrated fact. Dr. Isoart narrates in the "Journal Complémentaire" that he had a patient whose hair was naturally exceedingly fair, but when she suffered from fever her hair became red; after her recovery the hair resumed its usual color. Alibert mentions the case of a lady who after a fever lost her beautiful fair hair, and that after her complete recovery the new crop was quite black. These and many other cases sufficiently prove that the secretion of the pigment in the hair is closely connected with the animal economy, and that the condition of the hair deserves more attention than has been hitherto bestowed upon it.

Anomalies of Coloration.—The hair may be without pigment at birth or may lose it afterward. Congenital defect of pigment is noticed in the hair and eyes of Albinos, also in some of the lower animals, white mice, cats, etc. Besides the absence of pigment there occur other anomalies. The hair may be lost and be replaced by a crop of different color, either darker or fairer. Richelot relates the case of a young lady whose hair during an attack of chlorosis became quite gray two inches from the root. The rest of the hair remained unaltered. A cure having been effected by the administration of iron, the hair grew up brown again. The result was that while the lower and upper ends of the hair were brown, the hair was in the middle along a distance of two inches quite gray. Green and blue hair generally originate from foreign coloring substances, and have chiefly been observed among workmen laboring in metal manufactories.

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Spotted Hair—Speckled Hair.—Dr. Lieber, of Berlin (Hecker's "Lit. Aem.," 1828), records a most remarkable case of the discolorization of hair. Emily B., aged 16, with dark hair and dark skin, otherwise healthy, noticed at the period of puberty, on the left side of her face, a white stripe which crossed in an oblique direction the forehead, the eyelashes, and the cheeks; when the menstruation proceeded regularly the stripe disappeared, but the left eyelashes remained white, like those of a very old man. Before every menstruation the white hair increased both on the head and in the eyes, but disappeared when menstruation proceeded regularly. Dr. Vogel records the case of a man whose hair was gray on one side and black on the other.

Sudden Blanching.—A well-authenticated case of the sudden blanching of the hair is reported in Virchow's "Archiv" (April, 1866) by Dr. Landois and Dr. Lohmer. The patient, a compositor, aged 34, was admitted into the hospital July 9th, 1865, suffering from an attack of delirium tremens. A marked feature in the disease was the extreme terror when any person approached the patient. Nothing unusual had been observed up to the 11th, but on the morning of the 12th it was noticed with astonishment that the hair of the head had become quite gray in a single night. The patient was discharged September 7th, the hair remaining gray. The hairs of this patient were submitted to microscopical examination. The white hairs were found to contain a great number of air globules in the medulla and in the cortical substance, but the pigment was in every case preserved. In connection with this case, Dr. Landois quotes instances of blanching of the hair, in which each hair presented alternate rings of a white and brown color. A similar case was reported by Sir Erasmus Wilson to the Royal Society, on which occasion he presented a specimen of the hair of a boy aged 7, each hair presenting alternate rings of a white and brown color; Sir E. Wilson refrained from speculating upon the cause of the alteration of color. It should be stated that terror was very marked in Dr. Landois' case. In by far the great majority of recorded cases intense mental emotion was apparently connected with sudden blanching of the hair, but the mechanism of the change and how the air finds its way into the hair is far from being understood. It is more probable that the air globules are developed within.

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Cases of Hair Electricity.—Among the other uses of the hair may be mentioned that it excretes electricity and perhaps other imponderable substances from the body, and absorbs other substances from the surrounding atmosphere. The electrical phenomena of the hair of some persons whose heads emit electric sparks in combing or brushing, and whose hair stands on end during electrization, are sufficiently known. Generally speaking, the more hair a man has the greater the accumulation of electricity. The hairs, in short, are excretory organs; hence their abrupt and untimely removal may in some cases have serious consequences.

Dark Hair.—Light hair seems gradually becoming less common and consequently more appreciated in England than it used to be. Dr. John Beddoe, of Clifton, has collected large materials on the color of the hair, and thinks it probable that the physical qualities of the race may be to some small extent moulded (we say it is, and that to a very large extent) by the action of conjugal as well as of natural selection. In order to test this hypothetical influence, he has thrown into the form of a table the color of the hair of 737 women, aged between 20 and 50, who came under his observation at the Bristol Royal Infirmary, and the deduction he made from the figures obtained was that the mass of the population does not sympathize with the preference given by painters and poets to fair hair; hence fewer of light-haired women than of dark-haired get married in that part of the kingdom. When Dr. Beddoe penned this article the rage for fair hair had not yet commenced, and the people in Gloucestershire and Somersetshire are on the whole a dark-haired race.

Color.—The opinion that the color of the hair depends entirely on the pigment in the medullary substance is, nevertheless, still adhered to by many observers, although it has been proved by Griffith, of London, Mandle, Henle, etc., that the supposed pigment molecules were chiefly minute air-vessels which fill the minute cellular spaces of the medullary substance. The color of the hair is thus ascertained to depend solely on the diffuse pigmentation of the cortical substance, no matter whether the medullary substance exists or not. If this be so, the cause of grayness is not due to the opacity of the cortical substance, preventing the visibility of the medullary pigment, but because of the disappearance of the diffuse

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pigmentation of the cortical substance. The real cause of this disappearance is as yet unascertained. The medullary substance we know is not a constant constituent of the hair shaft. It is frequently absent in human hair. This is especially the case in light hair, especially those on the head. The absence of the medulla in the hair of new-born children whose hairs are shed is a certain fact. In short, the supposed black pigment is air. The medulla is not so frequently absent in the hair on other parts of the body. The hairs of the armpit appear reddish even in dark persons; this is probably due to the acids of the sweat. The hairs, owing to the action of the human acids, frequently turn red, as has been frequently noticed in the hair of persons exhumed after many years.

The coloring matter of the hair consists in part of two kinds of pigment, granular and diffused. The color of the hair is thus due partly to the imbeddal of granular pigment in and between the cells of the cortical fibres, and partly to the diffused pigment, which more or less saturates the cortical fibre cells. The papilla of the hair is probably the main spot where the pigment is produced. Another constituent of the color of the hair is the air contained in the air shaft and the medullary canal. Thus in senile canities in which the hair becomes gradually gray the pigment also gradually disappears, but in sudden grayness the pigment is found preserved, but the gray places show an abundant number of air-vessels both in the medullary substance and in the cortical layer.

Partial albinism is comparatively a rare affection, and but slightly touched upon in text-books. This affection was well known to the ancients. Celsus gave the name of vitiligo (from vitulus, a calf) to all affections presenting anomaly of pigmentation. Willan was the first who distinguished partial from complete vitiligo. Bärensprung, Simon, and Beigel have latterly treated of this affection. It was formerly believed that, apart from domestic and other animals, this affection was peculiar to the Negro races. Blumenbach and Sonnini gave descriptions of such piebald Negroes. Simon ("Deutsche Klinik," 1861), on the other hand, asserted that partial albinism occurred more frequently in the Caucasian race. Beigel speaks also of a semi-albinism of Negroes in whom some spots of the skin present an intermediate coloration between black and white. Bärensprung ("Deutsche Klinik," 1855) maintains that

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partial albinism, of which he had observed six cases in the white race, is almost always congenital, though only noticed at a late period. Rayer, on the other hand, is of opinion that in Europeans, at all events, partial albinism is always acquired. The etiology of this acquired albinism is as little settled as the change of color of the hair, especially in the sudden blanching of it. The modern name of leucoderma is equivalent to the term of partial albinism, which has been ably and exhaustively described by Mr. Jonathan Hutchinson in his work on "Rare Diseases of the Skin." Alibert saw during the "reign of terror" a young man turning suddenly gray during the night preceding his decapitation by the guillotine. Of the Prince of Béarn, afterward Henri IV., it is said that during the Bartholomew night, having reposed on his hand for many hours in great anxiety, he found that the right part of his head hair and beard had become gray, an instance of partial albinism. That such sudden blanching is, as some will have it, caused by the action of morbid secretions on the outside of the hair is possible, but not quite probable. We known how by simply listening to a horrid tale we shudder, as is popularly said get a goose-skin, and feel a horripilation. Most abnormal and involuntary manifestations in the skin, such as blushing, growing pale, shuddering, depend partly, if not chiefly, on the sympathetic nerve. Terror is the chief cause in all cases of sudden blanching. Trousseau gives cases in which, from a neuralgia of the trigeminal nerve, the hair on that side had become gray. Labat ("Afrique occidentale") says Negroes suffering from long-lasting diseases become sometimes so pale that they can be scarcely distinguished from a southern European.

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CHAPTER IV.

ALOPECIA.

ALOPECIA (from ἀλωπηξ, a fox, which animal is said to be subject to this affection) signifies the falling off or loss of hair, while calvities signifies baldness. Thus alopecia may be said to be the beginning or evolution of the disease, and calvities or baldness represents the accomplished fact. The lower animals afford us numerous instances of periodical losses and reacquisitions of hair and feathers. Animals with hair are said to shed their coats at certain seasons, while the feathered tribes are said to moult. In the human race the hair of the head falls to a slight degree in the summer and autumn.

The different forms of alopecia may be tabulated as follows:

Alopecia congenitalis.
Alopecia senilis.
Alopecia præcox.
Alopecia parasitica.
Alopecia somatica.
Alopecia follicularis.
Alopecia universalis.

Congenital Alopecia is an unusual condition. I have frequently seen children born with a scanty crop of hair, but never with an absolute absence of hair, and I should doubt such an occurrence. Those cases which have occurred under my own observation have been the children of parents who have lived in an unhealthy situation, have had their family rapidly, and the children have often got their teeth late, and their bones have been thin and soft.

The following case, from my notes, will afford a typical instance of what I mean:

A male child, aged 6 months, was brought to me for eczema of the groin and perineum. The child had on casual inspection absolute deficiency of hair, but on close examination small downy hairs could be seen here and there on the scalp, eyebrows, and external aspects of limbs. The condition

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was one which had not given the mother any anxiety. Her other children had a fair crop of hair when born; this child was the seventh in ten years. It had a square head, large epiphyses, and night-sweating, cried when taken up, and had been much subject to bronchial and intestinal catarrh.

I saw this child again when 20 months old; the hair system was then fairly luxuriant.

Children will often be brought because they have a deficiency of hair in one spot. I have a child under observation at the present time with a patch on the occiput, where the scalp is occupied by a circle of hair which is short and stubby, not unlike ringworm. This spot is exactly where the pressure of the pillow is most severe on the skull, and my patient, now 12 months old, has been laid much on the back.

Dr. Wyndham Cottle relates, in his work on the hair, a curious instance of complete congenital alopecia, but he does not tell us for how long the patient remained under observation, or whether the hair grew at a later period of life. Rayer cites the case of a man with a congenital deficiency of hair, so that his cranium appeared completely bald. The man's father presented the same defect. Dr. Bauz (Stark's "Archiv") records the case of a family in which the son was congenitally bald.

Alopecia Senilis.—Senile baldness is of such frequent occurrence among men of an advanced age that it almost seems a normal condition of the male head. Let any one, at the meetings of our learned societies, or from the galleries of the House of Lords or Commons, look down upon the heads of the members of the assemblies, and he will be surprised at the number of shining pates. As a rule, the hairs are wanting over a space extending from the upper third or to the vertex, and laterally near to the middle of the parietal region. No satisfactory explanation has as yet been advanced why baldness, having arrived at a certain point, should be arrested in its advance, for while it denudes the portion of head wherein, it is assumed, the intellectual brain dwells, it spares the posterior portion of the skull.

The back of the head, the lower portion of the lateral regions of the skull, and the temple retain the hair longest. Frequently an anterior strip of hair remains at the upper

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border of the forehead, and this growth is often ingeniously used by bald people to hide their deficiency.

The scalp thus deprived of hairs looks smooth, bright, and shining. It is smooth, because the hair has been removed; bright, because it has been frequently polished by the process of scrubbing; and shining, because in spite of the absence of hairs it is often oiled. The hair follicles in the early stages of baldness are perceptible; but when the disease has advanced they are only here and there visible. Where they are seen they are found to produce feeble wool-like hairs, called lanugo. It has been urged that the baldness of the crown is attributable to the wearing of head-gear which presses upon the blood-vessels and diminishes the supply to the regions which are stripped of hair. But it is more likely to be due to the hair being kept away from the light. Sailors, butchers, and others who go about without head-coverings are seldom bald. And I knew of an instance of baldness in a man who was completely restored after he had been sheep-farming in New Zealand, where he was in the habit of going the whole day without any hat or cap on.

Men are more frequently affected by loss of hair in old age than women. No explanation of this is known, but it may be due to their form of head-dress, which covers less of the scalp, exercises less pressure upon the blood-vessels, and by not covering so much of the scalp allows the light to have its full effect upon the unexposed portions. It cannot be due to their not devoting so much time to intellectual pursuits, as there is a very large number of deeply-learned persons, as well as common and dissipated people, whose hair grows luxuriantly; while many others who think but little, and live contentedly and unoppressed by care, lose their hair early in life.

The hairs in this form of baldness often turn gray before they are shed. It must, however, be understood that the alteration in color in no way leads to alopecia. There are plenty of old people with luxuriant hair of the most beautiful silver-gray. The hairs of the beard and other portions of the body do not fall out to any extent in senile baldness. In fact, a long white beard is often found in men whose pates are smooth and shiny.

The question as to what age we are justified in speaking of senile baldness may be answered as follows:

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As a rule, baldness should not commence before the age of fifty. If it occurs before this age, it is either due to hereditary predisposition or else it is due to some removable cause, such as disease of the scalp, sebaceous follicles, the invasion of a cryptogam, or diseased blood.

The question as to the cause of senile baldness cannot be answered in any other way than by saying that it is pathological senility.

If we examine the scalp of an aged person who has been bald for some time, we shall discover a wasting of hair follicles, connective tissue, fat granules, and sebaceous follicles. The covering of the skull, in the bald situation, is then dry and shrivelled, and especially is this discoverable where the tension of the scalp is great—*i.e.*, at the vertex of the skull or over the sagittal sature. But if we examine the scalp of a person advanced in years whose baldness is commencing, we will find hair follicles in many stages of atrophy: some producing puny hairs, others shrivelled up. This condition not producing complete baldness, patients rejoice over the downy growth upon their head. They are inspired with false hopes; and especially so if they have been using hair restorers or colored and scented oil, and have believed in the string of laudations accompanying each bottle. At this stage of baldness the sebaceous follicles are sometimes abundant; and it is not unusual to find bald-headed persons with very greasy scalps. As the disease advances the hair follicles cease to produce any hair, and the papillæ, together with the follicles, actually shrivel.

These changes are simply the changes of declining life. They are changes of degeneration. The investigations of Sir William Gull and Dr. Sutton, undertaken to explain the association of granular kidney and general degeneration of tissue, proved conclusively that in advanced life the whole vascular area undergoes thickening of its coats, and eventually obliteration of the canals. And it is to this change that we must look for an explanation of the baldness which is associated with advancing life.

Alopecia senilis is not curable.

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Alopecia Præcox.

This name indicates baldness coming on prematurely.

It may be said that baldness occurring in persons under the age of thirty belongs to this class.

They may be divided into two groups.

Firstly, those cases which are due to a disturbance of the nervous influence.

Secondly, those cases which occur in individuals congenitally disposed to the loss of hair. A common case of baldness from fright is reported in the "Gazette des Hôpitaux," No. 33, 1879. A girl, aged seventeen, who had always enjoyed good health, had one day a narrow escape from drowning, being crushed by a floor giving way beneath her. She was very much frightened, and the same night complained of headache and chills. The next morning she felt restless and had itching of the scalp. During the following days she steadily improved, with the exception of the itching. One day, on combing her hair, she noticed that it came out in great quantities. Three days later she was perfectly bald, and in two more days she lost every hair on her body. Her general health was good. The patient remained bald, and was still so when seen by the reporters ten years later. In one instance a patient of mine narrowly escaped being burnt to death, and in her case the hair of her head was nearly completely shed, but it grew again. Those cases which occur in one area, supplied by one particular nerve, show clearly how the hair may fail through aberration or alteration of nerve influence.

Thus Ruvaton mentions the case of a man in whom amaurosis of the right eye, as well as loss of color and shedding of the hair of the scalp, of the eyebrows and eyelids on the same side, resulted from a shock. Romberg saw bald patches develop on the head and great suffering from a trophic facial palsy on the affected side.

Cooper Todd reports a case in the "Lancet" for 1869, in which, in consequence of a concussion of the brain from a fall, hemiplegia and alopecia of the hair of the beard and of the head occurred. Also another case in which the hairs and nails were shed after the patient had been struck by lightning.

No satisfactory explanation can be given of these forms of

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loss of hairs. In a later chapter we shall discuss the question of nerve influence on the color of the hair.

It is undoubtedly true, nevertheless, that the hair is not infrequently shed through the influence of the nervous system. The shedding occurs quickly, and in all the cases which have come under my observation, unless there has been an organic lesion of the brain and spinal cord, the hairs have grown as abundantly as ever.

Among the exciting causes of baldness are enumerated excesses *in Baccho et Venere.* Thus Gumer gives a long list of bald emperors and kings who had distinguished themselves by their dissipated habits—Tiberius, Claudius, Galba, Commodus, Henry III. of France, etc.

The form of baldness which is found in the second group of alopecia præcox is well expressed in the following case:

J. C., aged 25, is one of six children, four of whom are boys. He is the youngest. His father was bald prematurely at 24 years of age. Two of his brothers have lost their hair. He has now, from the occipital protuberance and extending forward, an absolutely bald pate. The skin looks shining, and very few hair follicles can be seen with a strong lens. He has a fair crop of curly, dark-colored hair above his ears and below the occipital protuberance, which hair is not in the least gray, neither does it come out easily. His eyebrows, axillary, and pubic hairs are strong and firmly planted, and he has a well-grown mustache. He has never had syphilis or any other blood disease, and with the exception of occasional attacks of gastritis, he is and always has been perfectly well. There is neither history nor evidence of skin affection in his family.

I could multiply such instances to any extent, as the state is a most common one.

I will relate the notes of one more case, which is full of interest and affords much room for speculation.

Mrs. S., from Balham, is 55 years of age. She is one of four children. They are all well. Her mother died at 88; she had luxuriant hair. Her father died aged 72; was partially bald. She was perfectly well until the last seven years, at which period of her life she had an alteration of her menstrual function, the periods ceasing suddenly after a great loss. Since

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this she has got fatter, whiter, and weaker. She has great depression.

She is a large-framed woman, walks and talks slowly, answers questions very slowly. She has a stolid look. Her pupils are remarkably small and lazy. The whole subcutaneous tissue of the body seems hypertrophied, is dense, firm, and resisting; but it does not pit anywhere, excepting on her legs.

The joints of her fingers and toes have distinct lips, and are painful at certain times. She is sure that the weather and many kinds of food influence them. She has a constant noise in her head; it is like the noise made by a steam engine. This noise never leaves her. Her hearing and sight are normal. She has on her scalp a few long straggling hairs, but they grow at intervals, about eight or ten in a square inch. The hairs in other situations are normal. She lost her husband very suddenly, when her menstruation ceased, and she attributes her sufferings to this shock.

This is not a work which will enable me to enter into the discussion of myxœdema, on which the labors of Dr. Mahomed and others have so helped us, but I quote it as an instance of baldness in a woman who was free from any disease of blood or glands.

The growth of hair in women on the upper lip and chin, which occurs at what is known as the change of life, has been noticed from Shakespeare downward by general writers, but, so far as I know, it has not been observed by physicians. It is an acknowledged condition, as is the growth of adipose tissue which so often occurs in women between the ages of forty-five and fifty-five.

Alopecia Parasitica.

This little work not being a treatise on skin diseases, we can only notice such cutaneous affections as in their progress implicate the structure of the hair. Some cutaneous diseases are due either to an animal parasite or to the presence of a vegetable parasite. The former are called dermatozoa; the latter, dermatophyta.

The parasites which are formed in the interior of the body do not concern us here, nor those which merely affect the skin, such as the acarus or the different kinds of pediculi.

The following table, from the able work of Dr. McCall

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Anderson, of Glasgow, is very useful, and embraces the varieties which we will now discuss:

I. Tinea favosa..... ... .Parasite, Achorion Schœnleini.
II. Tinea trichophytina.....Ringworm. Parasite, Trichophyton.
Varieties.—1. Tonsurans.....Ringworm of the head.
2. Circinata.....Ringworm of the body.
3. Sycosis.....Ringworm of the beard.
III. Tinea versicolor.....Chloasma. Parasite, Microsporon furfur.
IV. Tinea (?) decalvans.....(Alopecia areata). Parasite, Microsporon Audouini.

Tinea Favosa. Syn. Favus.

Tinea vera, by Terry; mycosis achorina, by Virchow.—The true nature of this disease seems scarcely to have been known to the Greek and Latin physicians, while the Arabs recognized it as a special malady.

In 1714 Turner proposed naïvely to divide all chronic skin diseases into two classes. That class affecting the body was included under the common name of herpes, that affecting the scalp under tinea. Willan, finding the term tinea much too vague, substituted that of porrigo, of which he admitted two varieties, porrigo favosa and porrigo scutulata, which Bateman, the pupil of Willan, further subdivided into six varieties. This system prevailed in England and mostly on the Continent until in 1839 Schoenlein discerned in the scales of favus a vegetable cryptogam, so that favus was now considered a parasitic disease as much as itch. Since this date numerous pages have been written, both in this country and abroad, still a great deal of diversity of opinion exists with regard to the parasitic diseases of the skin. Some look upon the cryptogams as the cause of the disease, others as the consequence. There are others again, in England especially, who hold that there is only one vegetable parasite which produces different manifestations according to the situation in which it grows. They have considered that the Microsporon Audouini represented the cryptogam in its primitive state, while the fungus of favus was the fully-developed plant. The majority of dermatologists, however, recognize favus (or honeycomb ringworm) as a distinct species. The rapidity with which it grows, the typical and depressed cups, the mouse or apple chamber odor, the way in which it dips below the skin and clings to a hair, show it is a disease *sui generis* as much as is

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chloasma. This species of favus does not take root easily. I have tried once to cultivate a favus cup, but although the plant was allowed to remain in the skin for four days, no result ensued. The example quoted by Anderson (p. 27) on skin diseases proves that the disease is capable of being transplanted, but that in some skins at least it does not take root. The lightness of the sporules has been ascertained by the beautiful experiments of Bazin, who collected particles of favus crust in a basin of iced water placed fifty centimetres from a patient with this disease. The patient sat in a direct line with the draught out of this basin, and was asked to frequently scratch his head, the result being that favus cups were detached, carried in the current of air, condensed, and deposited in the iced water. Hebra inclines to the view that the various shapes of parasitic diseases are rather due to the development of the plant at the time the observation is made.

Against this view is the striking clinical evidence that one does not meet with patients who have chloasma, common ringworm of the body and scalp, sycosis, and favus. Individual instances are recorded where two or more have existed at the same time, but surely it is easier to believe how in these instances there have been two cryptogams planted and growing together. Dirt seems to be the most favorable condition to the growth of the favus germs, but it is not at all essential to their production. It is certainly rare to meet with it in those who are cleanly in their habits and whose general health is good. This *a priori* is what the experiments teach. That it is necessary for the production of favus that the spores and soil remain for some time in apposition with the skin, and in those who know soap but seldom, exactly this state exists. Many dermatologists, and chief among them Duvergie, believe in the spontaneous generation of parasites in the bodies of the poor and dirty. He and those who think with him support this view by the fact that parasitic affections sometimes get well in patients who are put under good hygienic conditions and ordinary internal medicine. Doubtless such cases do occur. But that it is cause and effect is another instance of loose reasoning which makes all therapeutics so much the child of falsity. Those of his school argue that these cryptogams develop in and around hair follicles. It would be just as rational to state that beds develop bugs.

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It does appear clear to one's mind that floating in the atmosphere are germs of disease, and that these germs want a suitable habitation. That this habitation, in the case of vegetable and animal cutaneous parasites, is often the product of dirtiness is undeniable, and finding this habitation, there germs, or spores, or plants will settle down and grow. The ink I am now using may be left undisturbed for a few days, and will be covered by a minute plant. To argue that this plant came from the ink is simply advocating the theory of those who deny the parasitic origin of favus and allied maladies.

Symptoms and Course of Favus.

The seat of favus is generally the scalp, but it may attack any portion of the body where the hair grows. In a gentleman who is now under my observation the disease commenced at the back of the neck, where I have seen ringworm commence in several instances, probably by sitting on a chair which has on the back the favus spore, and these are brought in contact with the hairs. At first the disease consists of yellow scabs, looking like glue. These will be found on minute examination to be pierced by a hair. They can be detached and will be found to run up and down like the blocks used in the rigging of a ship. They are about the size of a pin's head. These bodies consist of masses of spores which develop in the mouth of the hair follicle. The skin around will be found slightly raised in places, and the centre of the cup depressed. As the masses of favus grow, they coalesce until they form a complete crust on the scalp. If, however, the favus and pits are separate, a curious formation takes place, which consists of rounds at first concave, afterward convex; this dry sulphur-colored scab consisting of a structureless capsule and of innumerable spores and branches. Gradually, as the disease advances, the hair follicles become overgrown by the fungi. The growth of the hair is interfered with, it breaks off short, becomes dry and brittle, and falls out. When these scabs detach themselves, the skin, from pressure exercised by the cup halves, becomes atrophied, and is never repaired. The hair but seldom grows again upon the situations of the disease, and the papillæ having shared in the general atrophy, produce afterward a very poor and thin layer of epithelium, and for the rest of the patient's life these remain

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upon the head, bald, depressed spots. The growth of the fungus, together with the irritation caused by the parasite which finds here a suitable habitation, often produce a great deal of inflammation of the scalp. It is not always easy to distinguish between the scabs of eczema of the scalp and a favus cup, especially when the two are combined. Generally, I believe always, a favus scab can be removed without pulling the epidermis beneath it, while the scales of eczema leave behind excoriation. Favus attacks the head, as it has been said, more frequently than any other part. It may and does occur wherever there are hairs. Next in frequency to the scalp I have seen favus of the whiskers, mustache, and back, or in any situation where the plant is most likely to find an opportunity of growing.

Favus is a disease met with commonly among the lower animals, and there is every reason for believing that the domestic cat, which is frequently affected with the disease, often communicates it to the human being. An examination of the hairs in cases of favus with a low power even demonstrates the existence of the fungus. Garlands of spores will be seen projecting from the hair like festoons, while many and separate spores can be seen splitting up the fibres of the hair. Favus attacks at the same time the nails, when it is known as favus unguium, a most intractable disease. It will also attack in rare instances the epidermis, when it is known as favus epidermicus; when such is the case the mass of spots becomes hard, and in a few weeks falls off, thus curing the disease. It is interesting to watch a case of favus in any one who contracts in any way specific blood disease. In Fulwood's Rents, Holborn, a dirty court, I had an opportunity of watching two children who had typical favus of the head and scarlet fever, and with all its horrible, disgusting companions. During the height of the scarlet fever the disease appeared to fade. The lice multiplied with frightful rapidity, but when the fever had passed the malady flourished as luxuriantly as ever.

The diseases most likely to be confounded with favus of the scalp are psoriasis, impetigo capitis, and ringworm of the scalp, but if it is borne in mind that the crusts of psoriasis are of a dirty chalk color, are distinctly raised above the surface, and are always associated with psoriasis elsewhere, the distinction is easy, while in impetigo capitis the scabs are more

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uneven, more difficult to detach, and leave the epidermis abraded beneath them. The microscope will at once settle the difficulty.

Tinea Tonsurans.

Syn. Herpes tonsurans. Trichophytosis furfuraceus. Porrigo scutulata. Common ringworm. The Greeks described the pustule scars in the scalp under the name of *αχωρες*; the Latins preserved the name of achores. The word was probably given to diseases on account of the ravages produced by them in hair as a moth on fur. Almost every dermatologist has produced his own classification and specified a different nomenclature. To obviate the difficulty and confusion, many physicians—wisely, I think—would confine the term tinea to diseases affecting the hairs. There is no doubt that ringworm of the head is a highly contagious disease. In many cases it may be determined by careful inquiry that the disease is transmitted to the human being, but that its transmission takes place between man and beasts. I have now under observation a groom with well-marked tinea of his scalp and arms. He brought to me some hairs from a horse which I saw. These hairs were infested by a cryptogam which in no way differed from that which I found among his own hair. Much discussion has taken place as to the identity of the cryptogamic plants which are found in ringworm, sycosis, and alopecia, and much confusion has ensued owing to these discussions. The clinical testimony points to the fact that ringworm of the body and ringworm of the scalp are due to one and the same spore, because it is common to find patients with both on their bodies at the same time, and I have noticed on more than one occasion one segment of the circle on the scalp and the other on the neck. But hitherto I have not seen sycosis of the beard in the same individual with the ringworm of either the body or the head. Neither have I seen alopecia areata in the same subject as the other tineæ. The microscope reveals in all a form of plant-life which is not, I grant, contra-distinguished, but I do not care to base my judgment on this investigation alone. The broad lines of demarcation in clinical medicine help us more than the minute details, useful as the latter are. We must use a shovel sometimes, and not always a teaspoon.

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Symptoms and Course.

The different appearances presented by ringworm of the scalp are due to the different degrees of inflammation set up in the skin and subcutaneous tissue by the parasite. Thus in mild cases of the disease we at first notice round spots as large as a sixpence, which are covered with short broken hairs and dirty, chalky-looking scabs. These will spread, and if several occur in the scalp at the same time (which is often the case) they will run together and form large and irregular patches, which even extend to more than the size of a crown. These patches are always more or less round. At first it is difficult to recognize, as it only consists of a small erythematous patch, and the hairs are not affected; but as the epidermis becomes heaped up and the hairs present the broken ends, looking like cocoanut matting, the disease is easily recognized. There is very slight irritation associated with ringworm. Sometimes, in those who have thin, fair skins, vesicles form around the circumference of the ringworm, but this is not universally the case. In others the inflammation runs into suppurative processes, and then the epidermis is raised, red, and tender, while pus can be seen oozing out of the follicles. When this degree of inflammation is set up the condition is known as kerion, the suppurative process set up by the parasite destroys future development, and the disease spontaneously subsides. But in this case it will be found that so severe has been the inflammation that permanent baldness results, and the patient has left depressed, shining patches of baldness, which do not again grow hairs, for the simple reason that the hair papillæ are destroyed. The cure of ringworm by parasiticides strong enough to produce suppurating inflammation is often followed by a like unsatisfactory result. When the patches of ringworm are not inflamed they are of various colors, agreeing with the complexion of the sufferer. The hairs lack lustre over the diseased patches and eventually fall out. The disease may grow on any part of the scalp. Generally they are found over the occipital, not often the parietal bone.

If permitted to run its course, it may go on indefinitely. I have known it to exist for five years. The disease attacks fair children more than dark, is very unusual after the age of

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puberty, and is scarcely ever seen in the adult. It is liable to attack all classes, rich as well as poor. Upon microscopical examination the roots of the hair are found to be split up like a horse's tail, and between the hairs are found an innumerable number of spores, which spread into the shaft in wreaths.

Alopecia Areata.

Syn. Area Celsi. Alopecia circumaptis. Porrigo decalvans. Tinea decalvans.—This disease has been a bone of contention for many years, described by Celsus ("De Areis," Lib. VI., c. 49) under the name of area, and confounded since his time with ringworm, and all other conditions which often cause or leave, as a result of their ravages, bald patches on the scalp. A clear estimate of this very marked malady can only be obtained by observing that by alopecia areata we mean a contagious disease which occurs in all sexes and in all constitutions, preferring the middle-aged, commencing suddenly, without warning, and being manifested by the occurrence of round patches of absolute baldness, which patches show a preference for the posterior part of the scalp, but commonly occur on the parietal regions. The hairs around these patches are firmly implanted, and retain their lustre, their color, and their strength. These patches never spread beyond a certain circumference. They may occur at the same time, may run into each other, and produce extensive baldness. These patches are not limited to the scalp, but may attack the whiskers, eyebrows, or mustache, but in no case do they occur with anything like true symmetry. The hairs on other parts of the body do not fall out during the attack, neither does the general health suffer. The conditions which have been most often confounded with alopecia areata have been the remnant of bald patches which are frequently the sequel of lupus erythematosis of the scalp; eczema, or tinea tonsurans, where suppuration has occurred, or where the disease has been too vigorously treated; or burns, or any other pathological process which destroyed the hair papillæ, and also with the universal alopecia, described later, which attacks the whole hair system, which never recovers, and which is a constitutional disease. Alopecia areata begins, as a rule, in the head; sometimes several patches occur simultaneously. These patches have always

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a clear margin; they are smooth, whiter than the surrounding skin, because the hairs are absent, and somewhat depressed below the level of the surrounding scalp. This is very obvious if the scalp is shaved. These bald patches are immediately surrounded by hairs, which come out easily or which fall out spontaneously, until a certain size is reached, when the disease stops. The disease is now obvious. But little irritation is felt, and some patients do not complain of any itching.

Sometimes the disease is arrested in one spot and is spreading from another centre, and it must be borne in mind that a patch which has been cured may suddenly be denuded of hair again, but as a general rule, by appropriate treatment the malady is cured in from nine to twelve months. From notes of my own taken by Mr. J. H. Gilbert, I find that out of 671 patients, 13 were the subjects of alopecia areata; 3 were females, 10 males. The oldest was 33 years of age, the youngest 6. They were all cured, and the average duration of their treatment was about seven months. The following case shows the great tendency of the disease to relapse:

L. H., aged 30, has on right of ligamentum nuchæ and on the left of the occipital protuberance circular, smooth, and absolutely bald patches. She says the first came when 15 years of age, and the hair has grown three times. The parent patch came eight months ago.

Out of my sixteen cases four of them told distinctly of contagion; in two of these cases I confirmed their statements by my own observation. The following cases are so applicable that I may be permitted to quote them:

G. H., aged 13. Has had bald patches on head for two years. She has now well-marked patches on outer side of the sagittal suture of alopecia areata.

J. H., her brother, aged 11. Has one patch of emphatically smooth ringworm on the left of the occipital protuberance.

A. H., aged 15. Had a similar patch on the left of her parting, but she is now quite well. They say they believe the disease came from using a strange comb.

Again:

P. C., aged 29. Has two patches of baldness on his skull,

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which came without warning nine months since, when he was a clerk in a Paris bank. They are now well marked. His fellow-clerk, who worked at the same desk as himself, had a similar patch.

I could quote numerous other instances which point conclusively to the infectious nature of the malady from my private note-book, but I have preferred to use three which have been observed by others. The following case was under the care of another medical man as well as myself:

T. A., aged 14. Had a well-marked patch of alopecia areata over his right parietal bone. This was healed and cured in eight months in the ordinary manner. But unfortunately his cap was given away, and the boy who wore his cap contracted the disease.

Other writers—M. Gillette and others—have also quoted instances in which the clinical facts pointed to the contagious character of the disease. But the following, related by Dr. Hillier, is most conclusive:

"In a large parochial school at Hanwell, containing from 1,100 to 1,200 children of both sexes and from 6 to 14 years of age, a number of the children were found all at once to have on their heads patches of baldness quite smooth and pale. The patches varied in size from that of a fourpenny piece to an inch or more in diameter. In some children there was but one spot, in others two or three. The number of children affected was 43, and they were all girls from 7 to 14 years of age, who lived together. There was no case of the kind among the infants or among the boys, who occupied a separate part of the building. On more careful inquiry it was ascertained that one girl had been suffering from this disease of the scalp in an aggravated form for nearly six months, and had been allowed freely to associate with the others."

The microscopical evidence which we have found at the hospital has been wasted bulbs. Dr. McCall Anderson, in his work on skin diseases, gives a beautiful drawing of the spore and bulbs of the parasite found in this disease, and in some cases distinct evidence of the presence of mycelium and spores. The discovery and recognition of the low forms of plant-life

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found in tinea is one marked by many errors and fraught with difficulty. It is only successfully accomplished by great patience, care, and practice. But to argue the non-contagious nature of a malady from an inability to discover the contagium verum is a line of argument which would, if applied to a syphilis in the acute specific fevers, abolish their infection entirely.

Arguments have been adduced to prove that alopecia areata is due to nerve action, or rather to the aberration of nerve action. Voigl has shown that the loss of hair in advanced age is limited to definite areas in the distribution of certain cutaneous nerves. By section of the sciatic nerve in rabbits, he found that on the part supplied by that nerve hair had not grown four months after he had operated, while in the healthy part the hair growth was normal. Romberg observed that in facial paralysis the hair was shed at the affected part. Von Bärensprung is of opinion that failure of nerve force is the chief cause of baldness.

Those who have taken refuge in the nerve origin of the malady appear to base their deductions on the belief that the disease is due to suspended innervation of a given area, but this will not account for the long-continued relapses of the malady, the numerous points from which it commences, and above all other objections, it cannot explain why more than one member of a family are attacked at or about the same time. I would sum up my remarks with the following propositions:

1st. Alopecia areata is a disease which is capable of being transmitted from one person to the other, but not with the same ease as tinea tonsurans.

2d. That the disease is caused by a contagium verum which is most difficult to discover.

3d. That it is a disease which only attacks those regions which are exposed to the air.

4th. That it is in no way a constitutional disease—*i.e.*, it is not influenced by internal remedies. It does not affect the general health and is not hereditary.

Sycosis, Mentagra, Chin-whelk.

Pliny ("Historia Naturalis") gives in the first chapter of his twenty-sixth book an account of an unknown disease which, according to his statement, was imported by a Roman knight

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into Italy from Asia. It gave little or no pain, nor was it dangerous to life, but it caused such a deformity that death was preferable (sine dolore quidam; ac sine pernicie vitæ sed tanta fœditate, ut quæcumque mors preferenda esset). It was first called by the Greek name "lichenas," but afterward mentagra, on account of the chin being the chief seat of the affection. Women and—what certainly is remarkable—the lower orders and the middle classes were not attacked; but the nobles suffered severely, and spread the disease by their habit of kissing each other. Numbers of physicians came from Egypt for the sole purpose of combating the disease, and reaped a rich harvest. The treatment consisted mainly in the application of caustics, which, unless the skin was burnt down to the bone, did not prevent relapses. The description given by Pliny of its ravages and of its epidemic character is probably much exaggerated; but he mentions one characteristic of the affection which is even now peculiar to some of its forms, namely, its obstinacy and its liability to return unless radically cured.

Ælius Amidenus, a physician of the fifth century, relates in his "Tetrabiblos" that one Pamphilus treated at Rome the mentagra described by Pliny by a blistering ointment, consisting of oxide of copper, orpiment, hellebore, and cantharides; in fact, by a very powerful depilatory ointment.

Celsus gives in the sixth book of his "Treatise on Medicine" a pretty fair description of this disease. There is an ulcer, he says, which the Greeks call sycosis, because of its resemblance to a fig (the inner part of a ripe fig is probably meant), and he goes on to describe it with considerable minuteness. The first form (durum et rotundum), he says, is limited to the beard, and is probably true sycosis; but the other variety, which, he says, attacks the scalp, is moist and discharges freely offensive matter, is probably not a sycosis, but what we know as contagious porrigo. This species of tinea, called sycosis, or mentagra, is a disease of the beard, mustache, and whiskers; being most frequently found upon the skin, rarely affecting the scalp. It is characterized by spots or erythematous inflammation, involving the hair follicles, which patches frequently suppurate and give rise to considerable induration; and in some patients surrounding eczema is set up by the irritating influence of the discharge. The hairs which are at-

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tacked are easily extracted, and the bulbs will be found shrivelled. There is seldom any difficulty, even with a low power, in demonstrating the presence of the microsporon, especially those wherein suppuration has not taken place. As the eruption increases the hair follicles become more involved, and many of them obliterated, so that if the disease be not checked, permanent scars and bald patches may be left. The rapidity with which this disease advances is in some cases surprising. It is not uncommon to find a patient who has a susceptible skin much irritated by a discharge from a catarrhal state of the nasal mucous membrane about his nostrils; and I have notes of three cases where in about twelve days a true sycosis has existed. There is another variety of malady, which is found among men engaged in shoeing or grooming horses. These animals are subject to a malady known as the "grease," which in reality is a parasitic disease attacking the heels of horses; and I have in my possession the portrait of a man who cut his lip while shaving, and who almost directly afterward shod a horse affected with this malady. In three days he consulted me, with a condition of his chin and beard in all respects like sycosis, and the hair follicles were invaded by the cryptogams. I may say this man got rapidly well under the treatment for sycosis.

Although we have enumerated sycosis among parasitic affections, we are bound to state that some of the principal dermatologists, both in this country and on the Continent, such as Wilson, Hebra, Bärensprung, and others, doubt the existence of a sycosis parasite. Hebra looks upon the disease as a local inflammation, having its seat in the hair follicles, whose origin, he adds, is altogether unknown to him, and dermatologists have been challenged to prove its cryptogamic origin by demonstration before a pathological society.

The challenge was accepted by McCall Anderson, who, at a meeting of the Medico-Chirurgical Society of Glasgow, held in January, 1868, demonstrated without a doubt that the disease was associated with a fungous growth attacking the hair follicles. The fact seems that, as regards its cause, there may be a parasitic variety and a non-parasitic; so that tinea sycosis should, as Tilbury Fox suggested, be confined to the parasitic variety as contradistinguished from scyosis. And probably these cases, which one so often meets with, which baffle

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all our treatment, are not parasitic, but due to some directive agency governing the individual, such as scrofula or syphilis.

Alopecia Somatica.

The hair of the head is frequently shed in all the acute exanthemata, notably scarlet fever and small-pox. In these cases the alopecia occurs all over the scalp. The hairs seem to lose their hold of their follicles and drop out. Sometimes, but very seldom, the eyebrows and other hairy portions of the body are denuded. During the course of consumption the hairs always get much thinner and become long, straggling, and lie close to the head. This gives the very curiously white look which the scalp has in all wasting diseases, and which the laity recognize as a fatal omen. We need not be in the least anxious about these cases of loss of hair. The hairs fall out because the blood is of an unhealthy character; so soon as the normal state is restored the hairs will grow again as luxuriantly as ever, but sometimes of an altered color.

The cases on which we are often consulted, of young ladies who complain that their hair comes out in handfuls, are associated with the following train of symptoms: The patients tell their story, as a rule, with much confusion and tremor. Their pulse will be found to be beating rapidly. They are those who eat but little meat, scarcely take any exercise in the fresh air, and are always lazy, fretful, and weary. They suffer most from cold feet, backache, flatulence, and headache. Their bowels and menstruation are disturbed, and they form the great bulk of patients which frequent the rooms of the consultant. They are always anæmic, and they have many and varied manifestations of an erratic and wilful nervous system.

I do not include those cases of loss of hair which occur in women between forty and fifty in this group.

If we can gain the confidence of these patients, if we can prevail on them to go to bed early, to sleep eight hours only out of the twenty-four, to take an interest in life, to use their muscular frame by plenty of exercise in the open air, to eat a plain meat diet, to drink some beer with their meals, to avoid pastry, pickles, and sweets, much craved after by them, we shall scarcely ever need the action of the old pill of two grains

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of carbonate of potass and two grains of granulated sulphate of iron; but it will help us much if we order a stimulating pomade for the scalp, such as are given at the end of the book.

Syphilitic Alopecia.

The hair is often shed to a slight extent in syphilis. It occurs as a rule about the eighth month, and varies much in degree. Out of seventy patients laboring under this disease, I find fifty-nine had more or less loss of hair, and it has supervened from the third to the ninth month in my cases. Syphilitic alopecia commences generally on the vertex of the head, which is denuded often very rapidly. It may then affect the whole scalp. The hairs lose their gloss, become dry, discolored, and are easily combed out. True syphilitic alopecia need not be accompanied by local phenomena of eruption or desquamation, as it evidently depends on a special modification of the general economy. It is rarely general, mostly being limited to the summit and anterior part of the head. The loss does, however, in some cases extend to the eyebrows and the beard. This kind of alopecia is mostly transient; the hair grows again after the syphilis has been combated by a rational treatment.

In the usual course of the disease the patient does not complain of the symptoms, and it is scarcely perceptible. In other instances there is almost complete denudation of the scalp. Wherever this occurs, my notes seem to show it is associated with a good deal of indiscretion and much deterioration of the general health. A lady has just died under my own care, with the following painful history: She was divorced from her husband because of alcoholic excess and infidelity on her part. She contracted syphilis in December, 1882. She came under my observation with acute pneumonia in July, 1883. She had then absolute baldness, excepting a few very straggling hairs. The eyebrows were shed, and many of the eyelashes, but the pubic and axillary hairs were intact. She had mucous tubercle in the buccal mucous membrane and the tonsils. The glandular system was universally enlarged. She had been suffering from delirium tremens before her seizure.

The lung became gangrenous, and she died fourteen days after the commencement of the pneumonia. How much the

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syphilis contributed to the pneumonia it is not possible to say. I would only like to draw attention to the association of alcoholic excess, syphilis, and alopecia. I have frequently found those who have drunk heavily become bald early. The form of alopecia which occurs during the course of syphilis is not permanent, and must be met by appropriate constitutional treatment.

Alopecia Follicularis.

Those cases of loss of hair which occur in patients who have some other disease of the scalp are included in this group. The most common form of this disease is what is known as seborrhœa capillitii, or by the laity "dandruff," or "scurf." It is not a condition which occurs before the age of puberty. At first the patients complain of a good deal of itching of the scalp, which itching is worse when the head is hot; as after dancing or other violent exercise. "It prickles," the patient tells us. On examination of the skin on the head, especially at the summit of the crown, the head here is covered with a large quantity of scales, which in cleanly people are white, but in the dirty these scales become yellow. They are easily detached by scratching, and even fall off without friction. The collar of the coat will sometimes be almost covered by these scales of dead epithelium. The scalp beneath these scales is of an intensified color, but it is not weeping, as we see in eczema capitis. These scales sometimes accumulate and form a thick covering to a portion of the skull, which in one instance may crumble like chalk and in others contains more fatty matter, and mats the hairs together with a paste feeling greasy and looking like putty. This state is always associated with some loss of hair. But the milder condition may and does go on for many years without causing any anxiety until the hair begins to fall, as it always does in the course of time, and you now have added to the seborrhœa defluvium capillorum, a falling off of hair and later baldness. The patients notice the loss of hair at first very gradually, and it is only when well established that advice is sought.

The baldness is never sharp and sudden, as we find occurs in alopecia areata, but it is gradual, and the hair follicles produce for a long time downy hairs. In all instances the effect

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of the unhealthy state of the scalp is very obvious, because the hairs which grow in these regions where the disease is not are strong, firm, and well planted.

This form of loss of hair is generally remediable, especially where the patients apply before the hairs are all shed. The treatment will be discussed in the chapter devoted to therapeutics. The hair is often lost from eczema, psoriasis, impetigo, and, as has been mentioned, from lupus erythematosis; and in many instances irremediably lost. The process of denudation always occurs by the disease interfering with the nutrition of the hair root, by exercising pressure, but in none of these diseases is the baldness sudden.

There is often great difficulty in differentiating seborrhœa, psoriasis of the scalp, eczema, and porrigo.

But if we remember that psoriasis occurs in well-defined patches, is not universal, and is always associated with the disease elsewhere, we have no difficulty. Eczema attacks a large area, is associated at some period of its career with oozing, and with itching and enlargement of lymphatic glands; porrigo of the scalp is a disease of childhood, and is associated with a large amount of pus and epithelial accumulation, and affects other portions of the skin, we shall avoid errors either in prognosis, diagnosis, or treatment.

Alopecia Universalis.

All writers on alopecia areata have described an advanced stage of the disease which seldom occurs, and in which instance not only the hair of the head and whiskers are attacked, but the covered portions of the body. Thus Dr. Carson records in the "Edinburgh Medical Journal," Vol. V., a remarkable case of complete depilation. The patient, aged 35, tall and muscular, and apparently free from any constitutional disease, noticed one day on shaving a bare spot on the right cheek. On going to have his hair cut the same day, the hairdresser called his attention to a circular bare spot on his occiput. From this day the respective bald spots enlarged, until he had not a hair left on his head, on his face, or on any other part of his body. During the progress of depilation the patient felt neither pain nor any inconvenience. The series of cases published by Mr. Hutchinson in the "British Medical

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Journal" for 1858, contain instances where the baldness has spread to other regions than the face or scalp, notably No. 26, where the eyelids, lashes, beard, and anus were affected.

The late Mr. Startin alludes to similar instances in his lectures given in the year 1846.

Kaposi relates an instance of universal loss of hair in the case of a physician from Galicia, who shed the hairs of his head, eyebrows, eyelashes, beard, axillæ, and pubis. Other reference of allusion might be made from the works of dermatologists, but no useful purpose would be attained.

I was fortunate enough to exhibit the following most interesting case at the Pathological Society in 1882:

George Booker, aged 26, a carter from Sevenoaks, came on February 10th, 1881. He is a strong, very muscular, and cheerful man. His father and mother are both living. The father had a patch of scurvy on his right leg which used to itch very much (probably eczema), and his nails used to break off. Otherwise he was and is a very healthy man. He has brothers and sisters who, so far as he knows, are well and free from any skin disease. He gives us the following story: "Five years ago my baldness began in one patch in the middle of the back of my skull. Then others came on my head, and after these I got some white hairs and bald places on my eyebrows and whiskers. My sisters used to say I looked as if some one had thrown snow at me. These bald patches have gone on increasing until I am as you now see me. I am strong and well. I don't itch or feel cold. I have never had syphilis or a day's illness in my life that I can remember." On stripping him he appeared, on casual observation, to be absolutely bald, but on close inspection of the scalp, perfectly symmetrical patches of smooth and absolute baldness were found, which had convex margins, and beyond these convex margins were a few fine straggling hairs. There are a few straggling hairs on his upper lip. There is not a single eyelash left; on the external aspects of his arms and legs the hairs are fast disappearing, and they are disappearing in a regular symmetrical manner from centres which are readily seen and which have abruptly-defined margins. He has not more than a dozen hairs on his pubis or in the axillæ. In some situations, notably at the corners of his mouth and between the

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scrotum and thighs, the bald and convex patches are not only devoid of hairs, but also of pigment, the patches standing out in bold relief, and being of a dead-white, like those which we see in leucoderma. He has no other evidence of skin disease, neither of having had syphilis. I have seen the patient every month until the present time, August, 1883, and I cannot discover any further effort at the growth of hair. He continues in good health.

The case I now quote also occurred in my hospital practice:

William Morgan, aged 22, a telegraphist from Mile End, has on the centre of each eyebrow a patch of absolute baldness. The hairs have also disappeared from the centre of his mustache, and there are two symmetrical patches of baldness on either side of his chin. The lines of demarcation are very distinct. The patches itched a good deal when they first came. The pubic hairs are falling out, but not from any perceptible centre. On the 17th November I made the following note: "On the extensor surface of the left arm is a well-defined patch of baldness. The right arm is not influenced. On the front of both thighs are true patches which are nearly devoid of hair, and on the anterior part of the hip are two absolutely bald patches. The hair of the head falls out a good deal. There is one bald patch just above the occiput, the size of a shilling. He has some symmetrical gray patches on his whiskers. There is no history of family skin affection."

Four other cases have come under my own observation during the last four years. Three have been women, and one man. The noticeable peculiarities in my patients were:—

The symmetrical progress of the malady.

The loss of pigment, as well as loss of hair, on some of the invaded patches.

The incurable nature of the condition.

I examined carefully the hairs in all my cases, but failed to discover any spores or mycelium.

Skin diseases, which advance in a symmetrical manner, are not due to parasitic causes or the affection of nerves. Those cases which I have ventured to distinguish from alopecia areata are in no way related to it. I look upon it as constitu-

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tional, as much as I should psoriasis or leucoderma. In fact, I should argue that there is a very intimate connection between this condition and leucoderma, for in leucoderma we find the same symmetrical progression, the convex edges of the patches, the freedom from failing health, and the incurable nature of the malady.

I cannot help believing that these cases are much more common than is believed, or they have not often been described; probably those who suffer are anxious to hide their hairless state and do not seek advice.

For the same reason I have often discovered bald portions of skin when examining patients for other conditions. Such bald patches are especially found on the outer aspects of the limbs of those who have most friction of the clothes upon the skin; and it has appeared to me in some cases of prurigo, where the patients scratch themselves unmercifully, on the thighs especially, that the itching has been caused by the hairs being prevented from making their exit out of the mouths of the follicle by the pressure and friction of the clothes. If we examine these patients in a good light, we shall often discover rounded hard bodies, which feel like shot. These can be dug out easily, and when examined attentively will be found to contain an imprisoned hair, curled up like a watch-spring inside its follicle. I have under my care at the present time a street musician, who by a very ingenious contrivance is able to play upon several instruments at the same time; and in the movements which are necessary for him to accomplish his pandemoniary feat, he is exposed to much rubbing of the outer portions of his thighs and arms, and in these localities he has violent itching. The hairs here are all rubbed off short, and without any lens the curled-up hairs are easily discerned.

This form of prurigo is much worse in cold weather, and closely agrees with the disease which was described simultaneously by Mr. Hutchinson and Professor Dühring.

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CHAPTER V.

CANITIES, PILOSIS, GRAYNESS OR HOARINESS OF THE HAIR.

THE loss of the color of the hair is due either to advanced age—the physiological cause, or disease, or in some instances it may be caused by strong mental emotions, or it is an inherited tendency. The time of the appearance of that unwelcome visitor, the first gray hair, depends upon numerous circumstances. In most cases the gray hairs make their appearance singly, and the bleaching is first noticed at the root. Those who are becoming gray always show their grayness more after being cropped, because the black ends being cut off, the gray roots at once stand out more clearly defined. This is very apparent in horses after they have been clipped or singed during the winter months. There is no doubt that fat is the chief cause of the color of the hair. This fat is equally distributed upon the cortex of the hair; alkaline substances dissolve the grease and discolor the hair. This is why strong potash waters make the hair light-colored; and this is why fatty substances, such as oil or pomatum, render it a little more colored. The presence of air has been clearly demonstrated in the hair by Kölliker. Dark hair contains very little air; light hair a good deal.

ETIOLOGY OF CANITIES.

We have seen that, according to the prevalent opinion of anatomists and physiologists, the blanching of the hair is chiefly due to the disappearance of the dark pigment which is formed and carried into the hair from the papilla at the bottom of the hair sac. Pfaff entirely dissents from this opinion, however plausible it may appear. He found, on examining many white human hairs under the microscope, the medullary substance well filled with dark pigment cells. But how, it

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may be asked, can a hair filled with dark pigment cells look white? Simply because the cortical substance of the hair is so dense that the pigment cells do not show as before. In flaxen, light-colored hair the light passes through the cortical substance; in white hair the cortical substance reflects the light. So that it is this cortical substance which has undergone a change, as it now reflects the light, like thick frosted glass, while formerly, when the hair appeared of a darker color, the light was allowed to pass. The pigment often disappears entirely in very advanced age, but in the gray hairs of young persons the pigment of the medullary substance will be found in many instances to be unchanged. But just as there are gray in perfectly white hairs with dark pigment cells, so there are dark hairs without any pigment cells whatever. On examining red hairs closely it will be found that on the epithelial layer being scraped off, the cortical substance shows a reddish tint. For this reason there are perfectly red hairs entirely wanting red pigment in the medullary substance. Brown hair consists in every part of a light brown horny mass; black hair of a faint yellow horny mass; and only white hair shows, with the exception of the medullary substance, a perfect colorlessness of the horny substance.

We can easily ascertain the correctness of the observation, which runs counter to that contained in nearly all the manuals of physiology with reference to the colorlessness of the epithelial layer and the horny fibres of the cortical substance of the hair, by bleaching a human hair in chlorine gas. Chlorine soon deprives the epithelial layer and the cortical substance of its color, and the brown pigment in the medullary substance remains unaltered. Nevertheless, after a short action of the chlorine the hair appears of a bright yellow, and after a longer action quite white; but the chlorine has only taken up the color of the horny mass of the epithelial layer and of the cortical substance. Among the remote causes of grayness must be first mentioned heredity. Numerous instances of this kind are cited by ancient authors. One writes: "Grayness is a sign of gentle blood." It is, moreover, asserted that children of aged parents become sooner gray. Tarquin was born with gray hair. Seneca is asserted to have received his name from the same circumstance. It was formerly believed that such as become gray in early age die a premature death. Daily

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experience shows that there is no foundation for such a belief. I know of a family, all of whom became gray at twenty-one, but they have all lived to an advanced life. Voigt, Zeiler, and Plenk quote similar instances. Even trifling peculiarities in the disposition of the hair reappear in descendants. Mr. Hutchinson told me of a similar instance, and I have in my note-book several cases, all of which have been inherited: all have been in locks. The hoariness of the aged usually begins at the temple, whence it gradually spreads to the whole of the hair. The coloring matter is no longer provided in the same quantity, or is wholly withheld. Grayness in tufts is often noticed in the head and beard owing to some local affection of the skin. Hairs which grow on scars are usually white. The grayness of the hair is normally a very slow process. The gray hairs are at first very few, but gradually they multiply. In the great majority of cases men do not become gray before they are forty. Women retain the color of theirs to a later period. The nervous influence upon the hair, whether as regards baldness or grayness, is abundantly proved. Dr. Anstie (Reynolds' "System of Medicine") writes that after an attack of facial neuralgia he noticed that the hair of the eyebrow was whitened, and that gray hair was thickly strewn over the right side of the head for some time after the attack. Sir James Paget tells us in his lectures on "Surgical Pathology," p. 31: "No tissue, indeed, seems to be wholly exempt from the influence of the nervous force on its nutrition. In the cuticle it is manifest; and for its influence in acting, even through a considerable distance, I may mention a case which is also in near relation to those in which the hair grows quickly gray in mental anguish. A lady who is subject to attacks of what are called nervous headaches finds, in the morning after such an one, that some patches of her hair are white as if powdered with starch. The change is effected in a night, and in a few days after the hairs gradually regain their dark color." This extract leads us to the discussion of sudden blanching of the hair. Sir Thomas More is said to have become gray in a single night after being condemned to death. Lemnius relates the case of a young man whose hair and beard became gray in a single night after being sentenced to death, and who was so altered in appearance that no one could believe that he was the same person, for which reason the em-

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peror pardoned him. Thomas Campanella saw a monk at Rome named Ubipertus, who had been elected Bishop of Ratzeburg, but he was too young for the office. He went to Rome to obtain a dispensation from the pope, but being refused, became quite gray during the following night, so that the pope could not recognize him at first, but gave him the dispensation, saying: "Quem evidenti signa Deus probasset!—God had proved him by an evident sign." Shipwrecked persons have sometimes become gray in a short time, from fright. Henri IV. is said to have become gray within twenty-four hours about the time of St. Bartholomew's night. The story of Marie Antoinette, of Byron's Prisoner of Chillon, and Diana of Poitiers, are well known. The cases are so numerous of care and anxiety giving rise to gray hair that it has become proverbial.

> **Cura facit canos**
> **Quamvis homo non habet annos.**
>
> **Although a man be not in years,**
> **Gray hair on his head soon appears.**

Dr. G. Vogel says of himself that when he lost his beloved wife he became gray in a single night, in his thirtieth year. We all remember Shakespeare's saying, "Worcester is stolen away to-night; thy father's beard is turned white with the news" (Henry IV., 2d scene, iv.). I have seen a man suffering from delirium tremens whose hair turned gray after a violent fit of passion lasting several hours. It is not only the hair which is influenced so much by the nervous system. The blanching of the skin and blushing during anger are parallel processes. Young children become incontinent frequently when frightened. Dogs pass urine frequently when thrashed. The secretion of the liver appears to be much under the influence of the emotions. One of the prisons in London caught fire some years ago, and it was doubtful whether the outer wall would not tumble down. The fear of this had such an influence upon three of the warders that they became distinctly jaundiced a short time afterward. Numerous theories have been advanced to account for the rapid turning gray of the hair during violent emotion. It has been argued that the acidity of the sweat blanches the hair, but it would appear to me more probable that the whitening is induced by the action

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of the muscular fibres of the hair and sebaceous follicles. But the modus operandi has yet to be explained. We know that the condition of the nervous system influences the glands and their secretions. We know that there is a connection between the secretion of the sebaceous glands and the color of the skin. Is it, then, too much to say that the venous disturbance arrests the secretion of the fatty matter? Haller, as is well known, questioned the truth of all cases of sudden grayness; but Bishop says that he has himself seen six, if not more, such cases. Fright, we know well, causes the hair to stand upright, and painters have been wont to depict standing hair in order to express terror.

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CHAPTER VI.

CRINAL ABNORMITIES.

Plica Polonica and some other Affections of the Hair.

This disease of the hair, or rather, as we believe, of the skin, is at present confined to so comparatively small a territory that it is not surprising that it is so little known. It has many names on the Continent, but none in English (unless we call it "elf locks"), if this affection was known in Shakespeare's time (Romeo and Juliet). The hairs of the patient are matted and glued together by a quantity of secretion from some obvious disease of the scalp, such as eczema; and when the secretion is allowed to accumulate, it becomes the habitation of lice and various forms of vegetable life, so that it is not a disease *sui generis*. It is often endemic in Poland, Russia, and Hungary, but has seldom been described by English writers. We sometimes see in this country a disease of matted hair, called by the French tentrage—*i.e.*, felted hair. In this state the hairs become so matted by negligence that they can scarcely be separated by combing. In fact, when this condition is met with, the quickest mode of bringing the hair to its normal state is to have the scalp shorn, when, with proper care, the new hair will be normal, as the bulbs are not affected.

Expansions, Splitting of the Hairs.

In many diseased conditions of the scalp a casual observation will show the hair does not terminate in a fine blunt point, or in a cut surface produced by the barber's shears, but that the extremity is split up. This splitting occurs only in a few of the hairs, and it will be found that these are the longest and probably the oldest. If the examination is conducted by a lens of moderate magnifying power we shall probably find

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uniform dilatation of the shaft, and as the condition advances the uniform swelling disintegrates and the cortical substance of the hair is split up; yet as the upper and lower ends of the shaft still cohere, the split up actual substance becomes interlaced like the stretched fingers of two opposed hands.

These hairs having lost their natural elasticity do not yield when bent, but form an acute angle, and it will easily be understood how it is that the hair when exposed to combing and brushing becomes broken and fissiated. If we also remember that there are several of these nodules in the hair shaft, we shall have a good description of the phenomenon which Kaposi has dignified with the name trichorrhexis nodosa.

The hair of the beard is usually the seat of this affection.

It must not be understood that we are of the opinion that all hairs which are split at their extremity into a mere film have always present nodes in their shaft, because it is found that on almost any scalp a few hairs can be found with split film, and it will be further found that such hairs sit loosely in their follicles, and their roots look old and shrivelled, doubtless the fissure developed at the time when the hair was first growing, and as it gradually got further from the seat of the nutrient plasm the films lost some or part of the cement substance and became fissured like a broom.

The cause of this condition is still *sub judice.*

Bärensprung has described and figured a fungus connected with this abnormal state and has designated it "mycosis circinata." We have not been able to corroborate his conclusions. Rather should we believe it is a local manifestation of a general hardening and advancing brittleness of all the epitheline structures, because it will be found that in all cases of brittleness of hairs there is *pari passu* a corresponding splitting of nails and degeneration of teeth, the structures which are prototypes of the hair; and it will be found that in all such cases the body hairs are dry, lustreless, and sometimes nodular.

Feather Disease, or Phagmesis of the Hair.

There are a few instances recorded of reproduction of feathers instead of hairs in man. At Maccomp, in the county of Cork, a couple of black rabbits have been exhibited with feathers instead of hair. In 1831 there was exhibited at

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Bremen a boy whose head was covered with feathers instead of hair. The case is recorded in "Bäuerle's Magazine" for 1831.

Ringed Hairs.

Sir Erasmus Wilson has reported some cases of ringed hair —*i.e.*, hairs which have a black ring and then one white throughout the texture of the hair. The following case, which came under my own notice, demonstrates the possibility of the occurrence: J. Casper, a young man aged 20, consulted me for gray hairs. On looking carefully at the hairs by transmitted light, distinct, well-defined rings could be seen throughout the entire length of some, but not all the hairs of the scalp. He had been a very delicate boy, and suffered many illnesses. His scalp was supple, moist, and healthy, and the hairs were fairly implanted. He had on his nails a series of transverse white lines which occupied all the nails in his hands, exactly in the same way as those described by Dr. Wilks and Dr. Langdon Down. In other respects he did not present any disease. I am quite prepared to admit that no rational explanation has occurred to my mind which will account for the condition. The series of illnesses which he had passed through may so have influenced the disposition of pigment that the rings would in some way be found to be conditions of ill health which had preceded this state. I unfortunately lost sight of my patient, but I was inclined to believe that as age advanced, and if his health improved, the ringed appearance would cease.

Cosmetics.

In the previous edition of this work I did not treat of this subject, believing that it is not the province of physicians to lend themselves to those who would often abolish the grayness which add so much to the dignity and beauty of old age. Since this date, however, I have seen so many damaged scalps and hairs through using the numerous dyes, etc., etc., that I have endeavored to treat the subject so as to warn those who are desirous of abolishing the natural attributes of old age. No doubt the wish to enjoy perpetual youth and the desire to improve and beautify the surface of the body are not only the

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most predominant, but pardonable ideas in mankind. Cosmetics formed among the ancients a branch, and whole volumes might be filled with the mere titles of the treatises published by the Greeks and Romans, but especially by the court physicians, on cosmetics. The progress of chemistry has much simplified the subject, and has enlightened us as regards the dangers of making up the recommended preparations. As a general rule, all such preparations as contain metallic oxides or mineral acids should be viewed with suspicion. Every cosmetic which is kept a secret, in whatever form it may be manufactured, will in most cases be found fraudulently inert or injurious to the general health. Let no one imagine that it is possible to improve the skin permanently without attending to the purity of the liquids which circulate throughout it. There subsists an intimate relation between our internal and external organs. One of the earliest authors who has treated of cosmetics was Crito, a Greek physician of the time of Trajan. His work, which included cosmetics, consisted of four books. Excepting what are gathered from the writings of Galen and Celsus, little has reached us of his work. A recipe is ascribed to this author, by means of which Helena is said to have acquired that dangerous beauty which led to the destruction of Troy, at which time she must have been an elderly lady. The recipe consisted of the yolk of an egg and gum benzoin, which when applied would certainly render the skin smooth.

Hairdressers and Barbers of the Ancients.

The business of hairdressers and barbers among the ancients was a far more important one than among us, since they never had either combs or proper scissors in their hands. They were thus compelled to pass their early hours in the barbers' establishments (tonsilites), which were most frequently filled with idlers and gossips. Rich people certainly possessed the necessary implements and kept slaves for the purposes of the toilette. The tonsor, or as in vulgar language he was called the barbatorius, usually asked, "How do you have your hair cut?" For there were at least five modes of doing so. They generally used only one knife, sometimes two, which were disposed so as to form scissors. These tonsors also cut the nails, hence the "ad unguam factus homo" of Horace.

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Hair Cosmetics.

Advertisements for restoring the hair which has fallen off. The impudence of the advertisers is only matched by the credulity of the dupes. The best of their nostrums are those which contain nothing deleterious, and which are little more than the ordinary fats and oils colored and scented. The art of hair-dyeing and the embellishment of the hair was cultivated largely by the ancient Romans. Pliny cites a vast number for darkening the hair. They used goose fat, St. John's wort, myrtle, some of the peel of onions, etc. To prevent the hair turning gray, they used a liniment composed of the ashes of earth worms and oil, and bear's grease. The satirists did not fail to castigate the attempts of their time to conceal the ravages of years. Thus Tibullus (Lib I., Eleg. VIII., v. 43) has it—

> "Coma tum mutatur, ut annos
> Dissimulet; viridi cortice tincta nucis."

"You hide your age by dyeing the hair with the green rind of the walnut."

The women dyed and raddled (rutilatæ comæ) their hair and eyebrows. This dyeing of the hair sometimes brought its just reward. Thus we are told by Suidas (L. III. 43) that Philip, the father of Alexander, observing that one of his friends, named Antipater, whom he had appointed one of the chief magistrates, dyed his hair and his beard, removed him from office, saying that a man who is not sincere about his hair was unworthy of being trusted in what he had to do.

"Dicens, in capillis infidum, in rebus agendis fide dignum esse ne puta."

Soap was sometimes used by the Gauls for producing a reddish hair. Hair-dyeing, although in by-gone days a branch of the medical art, is now entirely in the hands of the perfumer and hairdresser, and it is remarkable how little attention English practitioners pay to hair affections. Very recently a surgeon applied to me for a hair dye which would not damage the hair in any way. It is only fair to state that this dye was required for a patient, and not for himself. He sent me at the same time a bottle which contained nitrate of

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silver, and another wherein was made up a solution of lead, two powerful remedies, and both certainly capable of damaging the hairs and scalp and also of producing metallic poisoning. There are, unfortunately, many dangerous dyes on sale. Most of them, however, no matter how romantically called, are simply so many solutions of lead, mercury, silver, or copper, combined with a decomposing agent. Some of the hair restorers contain as much as a drachm of acetate of lead in half a pint of water. Of a more complicated nature, but equally injurious, are sulphur and iron or sulphur and lead. Iron and sulphur have also been used alternately. There is a remedy in repute among hair dyes whose action can certainly be checked, and with which the hair can be colored in different shades. It consists of two separate solutions, one containing nitrate of silver, the other containing a solution of potassium. The solutions are applied to the hair consecutively, reaction obviously depending on the combination of the silver and sulphur. These remedies require the most accurate chemical knowledge; otherwise strange results may be obtained, such as green hair. The natural antagonism which has always existed in the profession against the use of metallic hair dyes has caused a good deal of attention to be given to the discovery of a vegetable and non-injurious dye. Dr. Pollack, a court physician in Persia, introduced a vegetable hair dye which is much used by the Persians to produce a dark-blue color, which is much prized by them. The remedy consists of the dried henna plant and of powdered indigo. These powders are, of course, entirely applied to the scalp, and it does not appear that they will damage either the hair or scalp. But so much dexterity is required that most undesirable results are obtained by those who are not skilled in their use. The hair owes its property of being dyeable to its porosity, which seems greater than its structure would lead us to infer. Sulphur being one of its constituents, renders it liable to be darkened when combined with some mineral substance, such, for example, as lead and mercury. The depth of the shade of color will, in many cases, depend upon the quantity of sulphur present in the hair. Thus as red hair contains more sulphur than dark hair, the effect will be greater. Dr. McCall Anderson considers a lotion of hyposulphite of soda the most perfect hair dye. A few applications rendered the hair of the part which was before

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bright red nearly jet-black, while neither the skin nor the clothing were stained. The red hair, as it grows, possesses of course the normal tint. The reason of the escape of the epidermis while the hair is dyed is that it contains no sulphur. The "golden yellow" color so much in fashion some years ago is produced by a solution of arsenic with a mordant of hydrosulphate of ammonia.

There are many instances on record of poisoning by cosmetics of a deleterious nature. Thus Horace Walpole ("Letters," Vol. III.) writes: "That pretty young woman, Lady Fortune, is at the point of death, like Coventry and others, killed by white lead."

Dr. George Johnson treated at King's College Hospital some ballet-dancers suffering from lead-poisoning by the use of flake white. John Hunter gives the case of a gentleman who exhibited symptoms of lead-poisoning from using a hair restorer to dye his gray hairs. The wash, when analyzed, proved to contain nearly three grains of lead in the form of acetate to the fluid ounce. Dr. A. S. Taylor ("Principles of Medical Jurisprudence") mentions a case of paralysis of the muscles of the neck from the use of a hair dye containing litharge.

I have myself seen two well-marked cases of colic, combined with a blue line on the gums, one in the case of a vain old *roué* who had for many years used a hair dye which contained acetate of lead; the other instance was in a patient who had dyed his mustache only.

It really comes to this, that all the dyes which have a mineral basis are not only injurious to the hair, but also to the scalp and the whole organism, and that all the vegetable extracts damage the hair. This I say with the fullest knowledge of the contrary statements made by the manufacturers of the many dyes; and as I said at the commencement of the chapter, I only enter into this subject to show the injurious effects which sometimes follow in the train of despotic fashion. When these ill effects are so clearly visible, it is the duty of the medical profession to expose their ill results.

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Rules for the General Management of the Hair.

The scalp should be well brushed twice a day with a fairly stiff brush. This brushing detaches any dead epithelium scales and dirt and at the same time stimulates the skin.

The hair should be tipped every other week, but care must be exercised that after tipping the scalp is not subjected to the barbarous rigor of having the hair brushed by machinery. This process tears out a great many healthy hairs and at the same time irritates the scalp and not infrequently damages the skin.

It is a good plan to have the scalp washed at intervals. Nothing is better than warm rain-water and a simple good soap, but care must be taken to thoroughly dry the scalp after this washing. In point of fact, it is this drying which constitutes the medicine of the process.

It is quite an undetermined point whether cutting and shortening the hair strengthens or prolongs its life. There are thousands of instances in which the hair has stood the test of time without ever being submitted to the hands of the barber, and in some regions of the body, such as the axillæ and eyelashes, the hair is never cut, and still it lasts so long as the organism, unless it becomes the victim of other diseases.

Still the truth is that if hair is left on the scalp and face, where it is exposed to so many external influences, it will become ragged and uneven at the ends, and it is for this reason that we advocate the cutting of hair every other week.

It is also necessary to admit that cutting the hair short does strengthen and thicken the shaft. The vital energy which is given off by each papilla is expended in producing thickness instead of length. It is for this reason that a practical and well-trained hairdresser will always promote the strength of hair by cutting off the tops of the growing and slender hairs in those who are getting bald.

Again, we must recognize now the necessities of social life. It would be a curious spectacle if men and women of the present day were to go about the world with shock heads of hair. What it is necessary to say very frankly and plainly is that hair cannot be curled by either paper, pins, or hot irons without damaging the hair both in length, brilliancy, and vitality. Any one who will take the trouble to examine the hair which

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is now manipulated over the brow so as to produce a fringe, will see at once that such hair is, by comparison with the remainder of the scalp, of a much inferior quality, and we need not wonder that a simple structure of our bodies can be used so barbarously and still grow healthily. I can call to mind numberless cases in which I have been consulted by women and men as well for falling off of the hair, and on inspection I have found the scalp has been irritated and has become scaly and dry; the hair has looked burnt and unhealthy in those positions where it has been subjected at periodical intervals to the curling-irons. Another great feature in the management of the hair is to give it plenty of liberty and free exposure to light and air. The wearing of false hair is injurious because it excludes the two latter. And in many instances hopeless and permanent baldness has resulted from a coil which has been worn on a certain portion of the skull for any length of time. The immense advantage of exposure to air and light is well illustrated by the condition found in the heads of the two services. The sailor, who wears a cap and is often bareheaded, has, as a rule, a good head of hair, while the soldier who wears often a terribly heavy head-gear, becomes, as a rule, prematurely bald.

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CHAPTER VII.

TREATMENT.

I HAVE avoided any reference to treatment while discussing the different forms of baldness, believing it would be better to take each variety separately, and endeavor by a rational therapeusis to place before my readers the plans which have been adopted for restoring the hair.. The only way of accomplishing this is to discriminate the varieties of the condition, and taking the indications for treatment from the pathological state, endeavor in each instance to combat the cause. I am conscious that many of my formulæ are complicated and old-fashioned; but I am convinced that the more agreeable we make the preparations which have to be applied to the surface of the body, the more will our patients be pleased to apply them, and the greater will be our success.

The form of baldness which we find occurring in young ladies at the spring and autumn of the year will be found associated with a feeble condition of the organism, as will be indicated by the pallor of the gums and general feebleness, with cold hands and feet. These patients usually require some preparation of iron, and I have never had the same success with any other form as with the pills made according to the following formula:

℞ Ferr. sulphat. granulata,
Potassæ carbonatis, ... āā 3 ij.
Tragacanth cum glycerini, . . . q. s.
Fiat massa et divis. in pilul. no. xlviii.

I direct my patients to take three of these pills three times a day for the first week, then to diminish the dose to two three times a day for the second week, and afterward to keep taking one three times a day until the general health is improved. I advise them to have the hair tipped once a month, not to use a machine brush, and to spend a great deal of time in the

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fresh air, without any head-gear; to partake of a generous meat diet, with a fair amount of fat, and where it is possible, to drink a pint of malt liquor daily, or some red wine. If this does not interfere with the digestion of food, I believe good arises from it. I advise them to rub well into the scalp the following washes, first the alkaline for a week, afterward the acid. The rubbing can only be accomplished by another person, who must be directed to use a piece of flannel or sponge:

ALKALINE HAIR WASH.

℞ Boracis, ... 3 i.
Glycerini, ... 3 ij.
Tinct. cantharidi, ... 3 vi.
Liq. ammon., B. P., ... ℥ i.
Ol. lauro-nobilis essent., ... ♏ iv.
Aquæ, ... ad ℥ vi.
Misce.

ACID HAIR WASH.

℞ Acet. aromatici, ... 3 ij.
Glycerini, ... 3 ij.
Sp. vini rect., ... ℥ i.
Liq. epispastici, ... 3 i.
Aquæ flor. aurantii, ... ℥ ij.
Aquæ rosæ, ... ad ℥ vi.
Misce.

Precisely the same treatment is applicable to the premature baldness which occurs in men who are out of health. But where the baldness is associated with another malady, such as syphilis, then appropriate constitutional treatment must be introduced.

Where there is an accumulation of dead epithelium on the scalp, this must be removed by a shampooing liquid. The following formula is a useful preparation:

℞ Sapo animalis, B. P., ... ℥ ss.
Aq. coloniæ, ... 3 viij.
Liq. ammon., B. P., ... 3 vij.
Aquæ destill., ... ad ℥ x.

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About a wineglassful of this is to be used twice a week; and the following morning the undermentioned pomatum is to be rubbed into the scalp:

℞	Medullæ purificati bovis, ...	℥ ss.
	Ceræ alb., ...	ʒ ss.
	Balsam Peruv., ...	ʒ ss.
	Liq. epispastici, ...	ʒ ss.
	Ol. rosmarini, ...	♏ iv.
	Ol. rosæ essen., ...	♏ ij.

Melt the marrow and wax together; then strain, and when nearly cold add the Peruvian balsam to the other ingredients. I believe the falling off of the hair in the aged has been retarded by this treatment, which will be found to make the scalp soft and healthy.

The cure of alopecia areata is always associated with very pleasing remembrances. Believing, as I do, in the communicability of the disease, I use in the first instance ointment made as follows:

℞	Acidi carbolici, ...	ʒ i.
	Hydrarg. bisulphureti, ...	gr. x.
	Lycopodii, ...	gr. iv.
	Glycerini, ...	ʒ i.
	Adipis recentis, ...	ʒ viij.

Misce.

This I order to be well rubbed into the bald patches every night for two weeks, previously cleansing the scalp with egg and borax wash. I then direct my patient to use the stimulating pomade until the hair grows, and in no single instance have I failed. In ringworm of the scalp I always refuse to treat the case unless the child has had the head shaved, believing it to be impossible to bring any remedy into contact with the fungus unless this be done. I then direct the scalp to be well washed with a liquid made by dissolving one drachm of the Pharmacopœia soft soap and half a drachm of carbonate of potash in twelve ounces of rose-water. After this is done I direct my patient to wear a piece of lint covered with oil-skin continually for a week, which lint is saturated every two hours with the following lotion:

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℞ Hydrarg. bichloridi, ... gr. vi.
Acidi carbolici, ... 3 i.
Sp. vini rect., ... 3 vi.
Glycerini, ... 3 vi.
Aquæ, ... ad ℥ vi.
Misce.

After this has been earnestly carried out, I am sure the disease will in but few instances give further trouble. The rings will probably be scaly for some time afterward, but if the head is kept clean and the nitric oxide of mercury ointment of the Pharmacopœia used at intervals, the normal appearance will be resumed. I have tried stronger parasiticides on many occasions in the form of ointments, sometimes as strong applications, which I have painted on; but the success I have met with has been very much less than when treated by the lotion. The wonderful penetrating property of the glycerin, which mixes just as readily with fat as with water, carries down the carbolic acid and bichloride of mercury to the very bottom of the hair follicles, and destroys the fungus.

In treating tinea favosa, I have been obliged to poultice the scalp for some days, and to take considerable pains in the removal of the cups before I could apply exactly the same treatment as for ringworm. In treating sycosis of the beard, I have always directed my patients to shave; and where this has been done, without so much pain and difficulty as might be expected, I have told them to bathe the affected spots with a warm lotion made with borax and carbolic acid, two drachms of the former and one drachm of the latter to the pint; afterward, to rub in freely equal parts of the oleate of mercury and glycerin. I have tried epilation, and if it were thoroughly done, it appears the most efficacious treatment; but usually the patient will not submit to your extracting the hairs, and it is a tedious process; if left to himself it is but partially done, and the difficulty in bringing the remedy to the fungus is almost insurmountable; while by shaving, the mouths of the hair follicles are exposed, and by so doing the parasiticide is permitted to penetrate the sac.

Eczema, pityriasis of the scalp, seborrhœa, and lichen pilaris will often tax our ingenuity greatly. In fact, eczema of the scalp is one of the most obstinate conditions we ever

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meet with. It is very often but an expression of a general dartrous state, and when this is the case, requires constitutional treatment; but it is to local remedies we must look for the best results. In the first instance, the head must be well washed with the shampooing liquid, freed from all crusts, scabs, and secretion. The hair should then be cut short, and an ointment carefully and freely applied to the entire scalp, made as follows:

℞ Hydrarg. ammon. chloridi, . . . 3 ss.
Unguent hydrarg. nit. dil., . . . 3 ss.
Lapis calaminari, ... 3 ss.
Ol. palmæ purificati, ... 3 ss.
Ol. amygdal. amar., ... ♏ ij.
Vaselini, ... 3 viij.
Misce.

It so often occurs that pityriasis and psoriasis of the scalp are only expressions of a generally diseased state of the skin, that apart from the local treatment we shall have to resort to arsenic in some form. When the patient is gouty we must combine the mineral with an alkaline; but when the skin condition occurs in the young, has a tendency to relapse, and is associated with a general depression of the state of health, we may employ the syrupus ferri phosphatis cum arsenicum et quiniæ (Corbyn & Co.), in teaspoonful doses, three times a day, with singular benefit.

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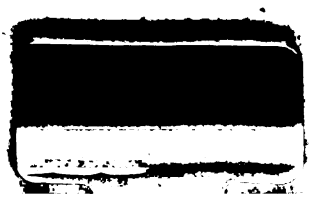

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